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UNITED STATES STEEL

AUTOMOTIVE INDUSTRIES

Published on the
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July 15, 1939

"Racing" for World Markets

Speedways may become a battleground where subsidized foreign designs compete for prestige and export dollars.

By ROBERT T. JACKSON

AMERICAN racing car supremacy in the annual Indianapolis 500 mile race, unbroken for two decades, bowed this year before what could be called the friendly foreign invasion of an Italian Maserati driven by Wilbur Shaw and owned by M. J. Boyle, of Chicago. Observers of the American racing scene are now pointing out that this foreign triumph in 1939 foreshadows more formidable and less friendly foreign invasions in future Indianapolis events.

The winning Maserati, raced as a "Boyle Special," dispelled all doubts regarding fitness of European cars, built for road racing, in speedway competition. In terms of actual speed, its performance was not phenomenal; as a matter of record, several American machines set up faster lap speeds. In the race itself, however, the Maserati performed with an undeniable consistency and its powerful brakes and fast acceleration through the gears played stout parts in keeping pit stop time at a minimum.

Most notable superiority of the Maserati machine was evident in its chassis. According to Wilbur Shaw, it possesses a degree of roadability heretofore unapproached in racing cars competing at Indianapolis. It rode extremely well and was easily handled at racing speeds without tiring the driver, qualities which undoubtedly had a strong bearing on its success. Tire wear was astonishingly low. Only two tires, a right front and right rear, were changed during the race. These changes were precautionary, made during stops for fuel, and, in the judgment of the Firestone technicians, the car could have gone the entire distance without tire replacements.

The Maserati is typical of European racing design in that it has independent front suspension, by torsion bars, a carefully engineered steering mechanism, very light wheels and rather soft springing all around. The advantages of this construction were demonstrated in convincing fashion during the race. As previously mentioned, several American cars were actually quicker by the lap, but in the race their unfavorable riding and handling qualities resulted in tire wear and driver fatigue which deprived them of the winning position.

Aside from the excellence of its chassis, the victorious Maserati also gave proof of a durability unexpected in American racing circles. Examination following the race revealed no failures, actual or incipient, of any parts. In fact, members of the Boyle mechanical staff feel the car could competently and safely complete another 500 mile race without further attention. In the past, foreign cars at Indianapolis have been regarded as lacking stamina for the distance, and this evidence to the contrary was a surprise to quite a few American followers of the sport.

Aside from the addition of reserve oil and fuel tanks, no changes of consequence were needed to prepare the Maserati, and it may be said to have started the race practically as received from the manufacturer. Very few instances of such readiness to race on the part of a brand new car are recorded in American

GENERAL

racing history, but it seems to be a commonplace state of affairs in European competition. In support of this statement may be mentioned the achievement of the German Mercedes organization in the recent Tripoli race.

This year's Tripoli event was run under a suspension of the International Formula, the Italians evidently believing that they could produce a national victory by the expedient of excluding the invincible German formula cars through restricting engines in 1939 Italian races to 1½ liters, a type with which they've had much experience. However, the Mercedes people, who strenuously denied having any 1½ liter cars at all up to within a few days of the race itself, descended upon a horde of luckless Italian competitors with a pair of spanking new 1½ liter engines and cars to match and mopped up first and second places without ever relinquishing the lead!

Two cars only, brand new and untried, no time to experiment if necessary, and Mercedes scampered home with first and second! Quite a testimonial to German methods and confidence; one which cannot be overlooked. As a matter of cold fact, the German machines, whatever their size, are quite superior to the Maserati as the latter is to our American cars. and the Germans will not take kindly to the prospect of their Italian compatriots pulling another Indianapolis victory out of the hat in 1940.

Damaging as it may be to our national pride and traditions, it is necessary to admit the forebodings of American observers for future races are well founded. If Mercedes and Auto-Union, as now seems likely, come to Indianapolis next year, our present American equipment will be hopelessly inadequate to deal with them.

This admission requires some explanation, as it is possible the exact nature of the European racing programs is not thoroughly understood in the United States. Mercedes and Auto-Union in Germany are known to enjoy government subsidies in addition to the huge amounts spent on racing by the firms themselves. Some subsidization is probably given Italian racing organizations but it is not openly admitted.

Lacking substantial subsidies, and without support from large manufacturers, French and British competition under the present formula is almost non-existent, and the future bears little promise of improvement in these countries, a fact greatly to be regretted since the British especially have done remarkable things in the way of obtaining high power outputs from very small engines.

However, with large sums of money available, German and Italian racing authorities have succeeded in developing engines of extremely high performance. Mercedes' 3 liter has an output of 420 hp. at speeds nearing 8000 r.p.m.; Auto-Union has not released any figures, but is certain to have almost the equivalent of Mercedes. Maserati foots the list with a claimed 350 hp. at 6500 r.p.m. for the car Wilbur Shaw drove at Indianapolis.

No less attention has been devoted to chassis design, and both Germans and Italians have arrived at unbelievably efficient types of chassis for holding the road at high speeds. Excellent riding and control have been obtained by intensive experiments with soft springing, using both torsion bars and coil springs.

Both countries employ their automobile racing activities as instruments of policy, using them to extend prestige abroad by piling up performance records attesting their national invincibility. Their manufacturers have successfully used these records in foreign advertising to bolster automotive exports.

Both nations draw upon motor racing for other purposes as well. Germany, for example, after the advent of the present government, set out to obtain research data for high performance aircraft engines, limited to this subterfuge by the terms of the Versailles treaty, at that time unrepudiated. To what degree the Germans were successful in this effort we are only now beginning to understand, but it is highly significant that the German pursuit plane holding the present world's speed record of 460 odd miles per hour is powered with an engine built by Mercedes - Benz, to date the protagonist in Germany's astonishing motor racing accomplishments.

This article is certain to draw criticism at this point for what is apparently undue emphasis on German

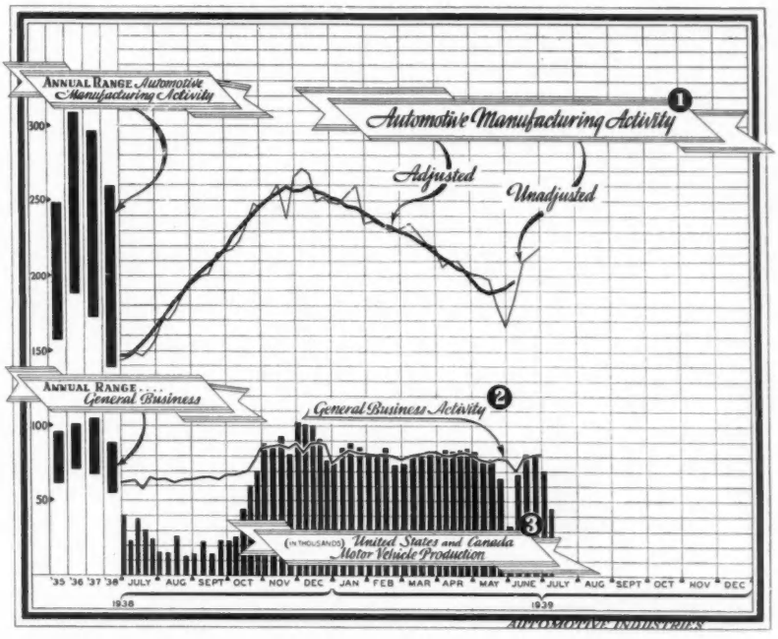
(*Turn to page* 75)

The Brass-Hat Rack

Mr. Twithmeyer, I wanted a miniature model for my desk!

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive and general business charted

End of Run Drop Will Effect July Totals

PRODUCTION operations on 1939 model runs were completed by many companies during the week ended July 15. That fact plus the Fourth of July holiday materially reduced total output for the first two weeks of July. Output for the week ended July 8 was estimated at approximately 45,000 cars and trucks. For the week ended July 15, production was expected to maintain this level with a possible total of 64,000 units. Several major producers probably will continue operations on their 1939 models throughout the entire month of July.

AUTOMOTIVE MANUFACTURING ACTIVITY for the week ended July 1 preserved the upward movement of the unadjusted index curve[1], lifting it to 219. This figure is four points above the unadjusted index of 215 recorded for the week ended June 24. The adjusted index curve[1] advanced to a higher level to reach 196, four points above the figure of 192 marked up for the week ended June 3.

GENERAL BUSINESS ACTIVITY[4] is reported as being "well maintained," despite the appearance of new uncertainties in the outlook at home and abroad. The business index of the *Journal of Commerce* for the week ended June 24 stood at 87.6, a new high for the year, as against 86.8 for the preceding week and 68.8 a year ago.

Increase in the volume of railway freight continued during the week ended June 24, with a total of 642,987 cars loaded, as compared with 637,873 cars a week earlier and 558,788 cars in the corresponding period of preceding year.

Upward tendency in electric light and power production was also maintained during the same week, with a total output 13.2 per cent above that of a year ago. For the week ended June 17, output was 13.7 per cent greater as compared with the previous year's record.

Average daily crude oil production for the week ended June 24 was 3,452,800 barrels, showing a rise of 5750 barrels from the output of the preceding week, but remaining below the current requirements of 3,491,000 barrels as calculated by the Bureau of Mines.

Bituminous coal production during the same period averaged 1,083,000 tons daily, as against 1,067,000 tons a week earlier and 862,000 tons a year ago.

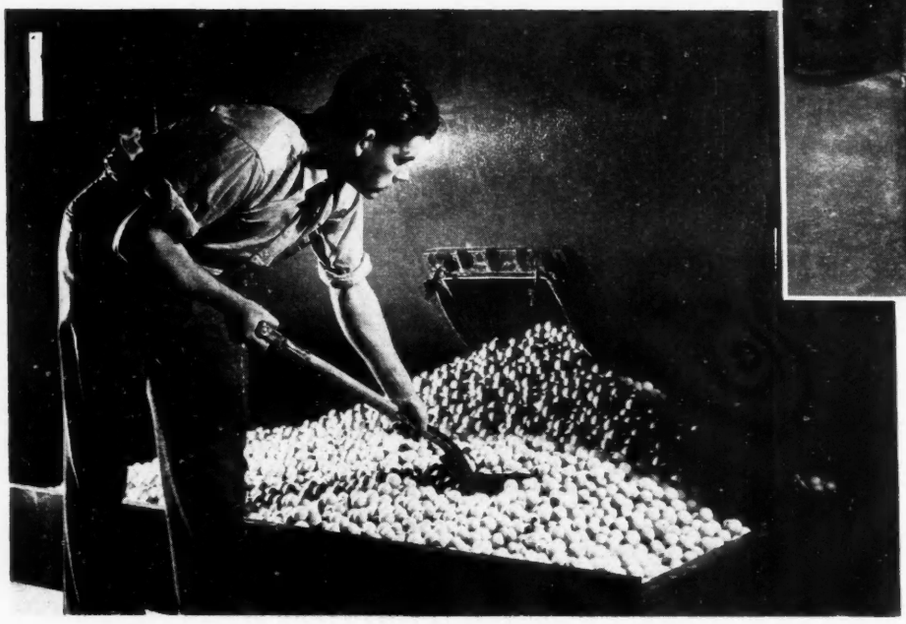
Professor Fisher's index of wholesale commodity prices for the week ended July 1 declined slightly to 78.8, as against 78.9 both a week and two weeks earlier and 69.3 three weeks earlier.

The General Motors-Cornell World Price Index of 40 basic commodities for the week ended June 24 was 61.3, compared with the previous week's figure of 61.1. The United States index in gold increased to 62.4.

The lumber industry during the week ended June 17 stood at 66 per cent of the 1929 seasonal weekly average of production, 68 per cent of the 1929 shipments, and 76 per cent of the 1929 volume of new business. Holdings of Government securities by the Federal Reserve banks declined for the first time in six years during the week ended June 28. The decrease, however, was attributed to technical conditions in the money market and not to a change in credit policy. The monetary gold stock increased $33,000,000, money in circulation $28,000,000, and member bank reserves $17,000,000.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp., New York. 1926 = 100; [3] Estimated by J. A. Laansma, Detroit News Editor, AUTOMOTIVE INDUSTRIES. [4] Summarized for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co. of New York.

Automotive MATERIALS 29



SPARK

FROM old-type wet clay molding, spark plug insulator manufacturing has progressed to dry powder compression methods. To obtain the proper powder, the Champion Spark Plug Co. loads two-ton charges of sillimanite ore into huge revolving mills, there to be ground by a revolving mass of 65,000 balls for 20½ hours. Mills are lined with sillimanite which also makes up the balls (1), thus wear particles are not waste nor foreign to the powder sought.

The sillimanite, now in the powdery form of billions of particles so fine they all go through a screen which has 130,000 holes in each square inch, is washed from the mill and the resultant creamy suspension spray dried in a tower 34 ft. high. This spray drying consolidates the particles into other billions of perfectly rounded dry pellets (2).

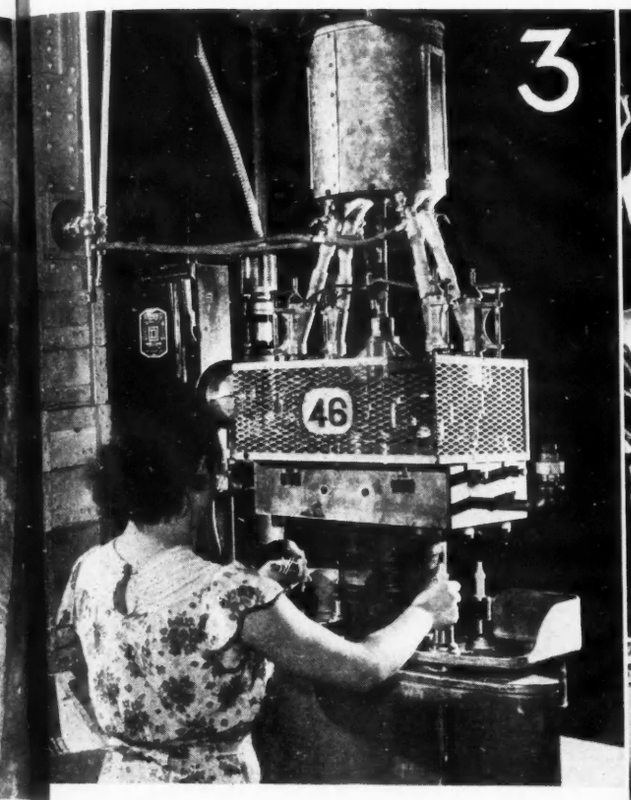
Flowing freely, like sand through an hour glass, the sillimanite powder is fed into flexible molds (3) where 5000 lb. per sq. in. hydraulic pressure exerts force equally from all sides to make the insulator blanks.

A grinding wheel turning at 4200 r.p.m. shapes the insulator blank into finished form (4). Ribs, grooves and general contour are for the purposes of heat dissipation, serviceability and identification. The insulator at this stage of the manufacturing process approximately 15 per cent longer than it will be after heat has further solidified the sillimanite.

The blank takes on a ceramic coating that later fuses to a glassy finish called glaze. The coating is uniformly applied as the wheel (5) revolves the blanks against rollers carrying a supply of glaze. Blanks are then placed in saggers.

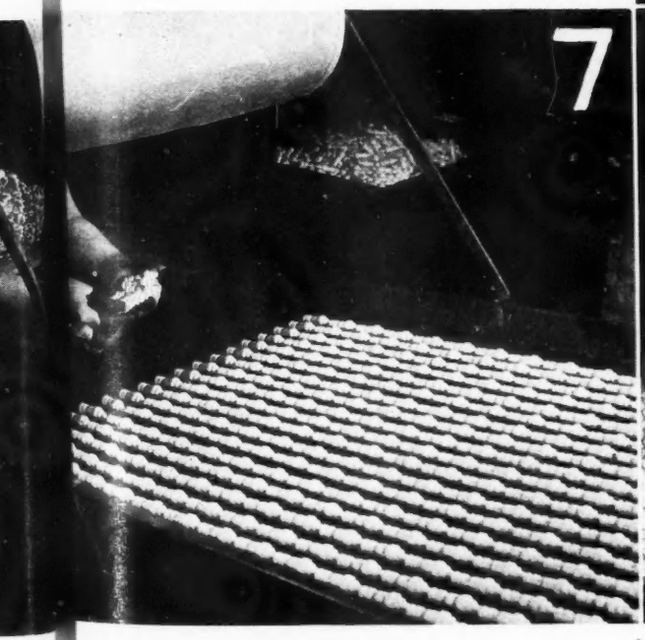
Cars carrying saggers pass through a tunnel kiln where temperatures, automatically controlled to within 6 deg. F., are graduated to and from a peak of 2600 deg. F. Saggers are 72 hours in this kiln, traversing the first 200 ft. in rising heat, the last 100 in a steady decline. The kiln cars contain at least one set of pyrometric cones (6), each cone with a different softening point. Experts can read from the angle of these cones the efficiency of heat treatment.

The trade mark is fired on in special decorating kilns. Then the insulators are pushed down a ramp (7) for the final inspection. The Champion insulator division in Detroit, has a capacity of 30,000 an hour, a yearly run in millions.



K PLUG

insulators require two weeks for completion. Here the operations are explained and shown in a sequence of seven illustrations



New Steels to Meet New

By ERNEST F. DAVIS†

THE growth of the motor car industry, the demand for excellence of ordnance material during the late war and the necessity for more durability of lighter sections in aeroplane construction have no doubt been the three major stimuli for the rapid developments in metallurgy during the last few decades. Contributory to this may be included the automobile parts maker who has concentrated on specialization of products. By this is meant the spring manufacturer, the gear plant, the builder of automobile bodies, the valve makers and many other auxiliary industries who have made huge contributions toward the sum total of automotive progress.

Photo, courtesy of Mid

Steel is the paramount material of construction inasmuch as 20 per cent of all American steel production is consumed by the motor car industry. In this initial source of material is the crucible, both literally and figuratively from which all our progress is born. An eminent metallurgist connected with a well-known steel plant once said that the making of steel will always be an art rather than a science, and while this is unquestionably true, yet the older methods of making steel by a definite formula of so much scrap, pig iron, limestone and ore and following a standardized continuity of melting practice is being changed to precision melting and exact scientific control. Today extreme care is taken in every operation from the selection of raw material, ingot design, rolling temperature and each step in the process of steel manufacture, even after the finished rolling if cold shearing properties are required, and Magnaflux testing for pipes and seams if consigned for aviation purposes.

For alloy steels the progress of the open hearth heat is determined by observation of the slag which gives positive indications of what is transpiring in the furnace.

In present-day practice a definite lime silica ratio is maintained. Primarily this is an economic means to prevent over-additions of raw materials such as ore, limestone or pig iron but also to prevent the readsorption of sulphur and phosphorus in the bath.

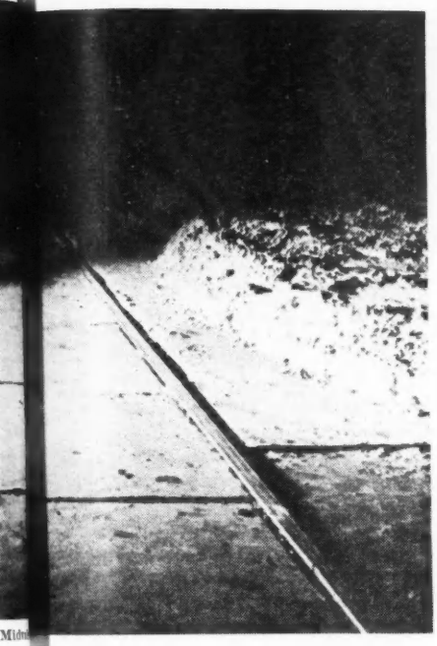
Formerly it was easy to determine electric furnace from open hearth steel by an analysis of the steel for sulphur and phosphorus and an examination for cleanliness. Today so close is the quality of open hearth steels made by alloy practice in the leading steel mills that it cannot be determined by these simple tests. It is not at all uncommon to obtain open hearth products with sulphur below 0.025 and phosphorus below 0.015 per cent. As a result there has been a notable decline in the use of electric furnace steels for production applications except in aviation requirements, bearing steels, stainless and tool steels.

Another scientific instrument now in common use in the leading steel plants on the open hearth floor enables carbon determinations to be made in 3 to 6 minutes. It is said over 90 of these are being used in various steel plants.

During the progress of the heat a small amount of steel is ladled out and cast into a small diameter rod having a sink head with much the appearance of a small funnel. The casting is cooled and placed into the small opening of an instrument known as the Carbometer. The rod becomes the core of an electromagnet. The induced current is then measured by a galvanometer. The carbon content of the steel affects

† Chief Metallurgist, Warner Gear Division, Borg-Warner Corp.
* From a paper entitled "What Is New In Heat Treating Methods, Materials and Processes" presented June 2, 1939, before World Automotive Engineering Congress of the Society of Automotive Engineers.

Requirements of Industry



the amount of current which can be transposed into percentage of carbon. It is thus possible to keep continual checks on the oxidation of carbon down to about 0.10 per cent. Only the final tests of the heat are sent to the laboratory.

Another method is the determination of the FeO content of the heat just before tapping. This is made by adding an excess of aluminum to a ladle sample and then determining the residual Al_2O_3 by analysis or a Turbidimeter.

Of recent years there has been an increased trend toward the employment of fine grained steels and a demand on the steel mills for grain control. Certain types are normally fine grained such as the chrome vanadium steels whereas others are normally coarse. But to make the majority of the alloy steels coarse or fine grained to demand, is one of recent accomplishment. Today either type may be made at will.

The reason fine grained steels have become so popular is their ability to be hardened without undue brittleness but maintaining toughness and resiliency after hardening due to the shallow hardening properties. In gear steel, for example, the distortion has been found to be less than the coarser grained steels hence these steels are very popular in the gear industry. In the carburizing steels direct quenching after carburizing is becoming more and more the standard practice. By this method of hardening no further heat treatment is given the steel except a low temperature tempering after quenching. Modern steels do not coarsen at the carburizing heats and no more heat distortion occurs than at lower heats, thus simplifying the hardening practice. Until the steel industry was able to insure grain size such a practice would have been folly to attempt.

In both carbon and alloy steels of fine grain microstructure the problem of machining has been a difficult one where smoothly machined surfaces are prerequisite such as gear teeth. To improve this condition attempts are being made to introduce other elements into steel in order to compensate for the fineness of grain and inherently stringy characteristics of the material.

Sulphur and phosphorus are well known aids to machinability but in steels of better quality both of these are often taboo to consumers and their use mostly confined to the free cutting applications. Phosphorus is undesirable because of its treacherous cold short properties, but sulphur is claimed to be advantageous when purposely incorporated in the ladle and is not existing as residual sulphur. Sulphur added in this way is usually done with great reluctance by the steel maker for it is claimed it adds from $3 to $5 in shipping cost per ton.

Many of the rarer elements have been tried out and some of these have shown promise but elements such as zirconium, selenium, columbium and uranium are prohibitive additions for production steels although some of these are used in the 18-8 stainless steels and have proven aids to machining properties. Zirconium in small quantities has been found beneficial in improving machinability in the higher manganese steels. An important contribution to this problem came out of a steel company in the Chicago district—a steel containing lead.

Lead does not alloy with iron but occurs scattered through the matrix in finely divided particles of metallic lead often displaying the characteristic cubicle pattern. But in rolled and forged steels it is found most frequently in long stringers which sometimes under high magnification have the appearance of vertebrae. Lead being a plastic would conform to the strain lines of rolling and forging and these stringers are presumed to be effective in breaking up the continuity of the ferrite and thus promoting improvement in machining.

Approximately 0.25 per cent of lead is considered to be essential in producing a noticeable effect upon machinability and so far it has been difficult to hold much more than this dispersed throughout the metal mass. Although a number of different methods have been tried to introduce the lead into the steel the commonest way is to have a small stream of lead shot pouring into the ingot as the steel is being teemed into the mould. Dispensers are used, arranged to spray the shot over

the greatest surface possible and timed so that it will not be emptied until the ingot mould is filled with steel. Correctly done it is claimed about 80 per cent recovery of lead is obtained. Lead being heavier than steel would find its way to the bottom of the ingot.

Uniformity of distribution is all important for if one portion of the ingot would be rich in lead and another portion lean of lead a vast difference would occur in machinability. This has frequently happened when steel companies have first attempted to make this steel.

When this steel is properly made, some remarkable results have been reported. On one job S.A.E. 1115 steel was specified to make a small plunger. Eleven seconds were required to produce it. When lead was introduced into this same steel the time required was reduced to 3½ seconds. This was cold drawn steel with a turning and cut off operation on a six spindle automatic. On fulcrum shafts of S.A.E. 1020, which is always a bad machining steel on automatics, the addition of lead proved to be beneficial. On several jobs the surface speed was increased from 75 to 125 surface ft. per min.

It may therefore be realized that if segregation of the lead occurs and the speeds and feeds have been increased to compensate for the lead additions, that very

(*Turn to page* 80, *please*)

NEW DEVELOPMENTS

New Surface Treatment for Aluminum Pistons

A new surface treatment for aluminum pistons, intended to improve their wearing qualities and especially to prevent scuffing during the running-in period, has been patented by Harold K. Work and Charles J. Slunder, the patent (U.S. patent No. 2,157,155) being assigned by them to the Aluminum Corp. of America. The process consists essentially in first anodizing the wearing surface of the piston and then applying a coating of deflocculated graphite to the anodized surface. To ensure better adherence of the graphite to the aluminum-oxide coating, the deflocculated graphite suspension is mixed with a solution of sodium silicate (waterglass).

In a particular application of the process, the pistons after machining were cleaned and then immersed in an electrolytic bath containing 15 per cent sulfuric acid. They were then connected as anodes in an electric circuit, and current at 23 volts was sent through for about 30 minutes, the current density being maintained at 11-12 amp. per sq. ft. and the temperature of the bath at 75 deg. Fahr. This anodizing treatment provides a coating of aluminum oxide which is said to act as a binding medium for the graphite.

After the coated pistons had been washed and dried, they were "painted" with a mixture made up as follows: One part of a 25-per cent solution of sodium silicate having a ratio of silica to soda of 3.25:1 was mixed with two parts of an aqueous dispersion of finely divided deflocculated graphite made by diluting concentrated "Aquedag" with 3.5 volumes of water. The coating was allowed to dry and was then heated to 230 deg. F. for an hour to complete the drying.

A few days later the pistons were installed in an automobile engine for testing and observation, and they were then subjected to 65,000 miles of service under temperature conditions varying from hot to extremely cold. After being removed from the engine for examination, the pistons are said to have been found in excellent condition as regards surface appearance, and substantially free from the effects of wear and scuffing.

Zirconium Copper Available in Form of a Concentrate

Zirconium-copper, a new material for improving standard brasses and bronzes, is now supplied in the form of a concentrate by P. R. Mallory & Co., Inc., Indianapolis. The zirconium not only acts as a deoxidizer and scavenger of melt, but when alloyed with manganese bronzes, aluminum bronzes, and others, it is said to give increased hardness and tensile strength, higher thermal and electrical conductivity, and improved corrosion resistance. Fine grain materials with clean grain boundaries result from its use.

The zirconium-copper concentrate has been found to be of particular advantage in producing nickel bronzes. The ductility of such alloys is substantially increased, giving greater reliability to sand cast material.

Mallory metallurgists have developed new methods of heat-treating zirconium bearing alloys to further improve their properties and make them particularly resistant to creep and oxidation at elevated temperatures. Proper melting and pouring methods have also been worked out.

Two standard concentrations, containing 12½ per cent and 35 per cent zirconium, are supplied. The most widely used concentration is the 35 per cent zirconium-copper which is furnished in the form of bars and lumps having a high density. The concentration will alloy immediately and without difficulty with a melt, resulting in the highest recovery of zirconium.

The PLASTIC Automobile

A possibility for the future depending on the improvements in Plastic Resins

THE automobile designer has for a long time dreamed of a motor vehicle which could be molded or pressed in one piece out of some composite material which would have high strength, toughness and resistance to shock, beauty of color and a smooth, durable finish. The production men dream of a material which can be easily formed or shaped, and which attains a highly polished finish with very little labor or machine work.

It should be realized, says S. G. Saunders, staff officer, Chrysler Corp., that plastic resins could be made to fit the foregoing description if they were only improved. Mr. Saunders, in a paper presented a short time ago before the American Chemical Society, expressed the view that engineers are actively interested in plastic resins and would consider them for most any part of the car where they would be economically and structurally advantageous.

> ***THE ideal plastic material for use in the automobile would have the strength and rigidity of alloy steel, the ease of forming and shaping of potter's clay, the toughness of sugar maple, the colors of the rainbow, and the finish of "Superfinished" tool steel.***

The paper contains a number of enlightening points with regard to the use of plastic resins not alone for decoration but for such items as inside door panels, whole instrument panels, garnish moldings, grilles, windshields and door windows, head lamps, hub caps, gas tanks, pumps, pulleys, oil pans, transmission cases, body panels, fenders, etc. Some of these points follow herewith.

If plastics are to be adopted as a major material for use in automotive structures they must possess high strengths. The tensile strength must be at least 40,000 lb. per sq. in. to compete with body steel; the compressive strength should equal this; and the sheer strength should reach a figure at least three-fourths the tensile strength.

One of the desirable characteristics of cast iron and steel in all mechanisms is the ability to withstand high stresses with very little or no deflection; in other words, they possess a high modulus of elasticity. Plastics will have to have their modulus increased to 12-15 millions in order to keep deflections within good production and engineering limits. Not only must they possess this quality, but they must have a definite stress-strain ratio. This would mean that they should follow Hooke's law and should not undergo dimensional change at low stress, nor cold flow.

Many parts on an automobile in the proximity of the engine are exposed to high temperatures. In order to use plastics for these parts the strength must remain fairly constant up to around 500 deg. Fahr. Other parts which are exposed to the elements experience temperature changes from 140 deg. Fahr. down to 50 or 60 deg. below zero. These parts must not become embrittled at low temperatures and must retain their original structural strength. Impact strengths around 3 ft.-lb. (A.S.T.M.) would be acceptable at these temperature extremes.

Decorative plastic materials which are attached to metal parts should possess coefficients of expansion very near or equal to that of steel, or to whatever metal to which they are attached. Some flexible but high strength plastic bonding material might be used as an intermediate material between the plastic decorative material and the metal insert or backing. However, it would be very desirable to have a plastic the same expansion coefficient as that of steel.

One other property which would be highly desirable is that obtained by alloys in steel and cast iron. These properties are variable strengths, ductilities, and hardnesses obtainable by heat or chemical treatment.

Many parts of automobiles formerly produced by casting or other hot forming operations are now produced by cold working. The body panels, wheels, frames, and many small parts are produced by cold stamping or pressing. Small parts like bolts, levers, and rod ends are manufactured by means of cold upsetting operations. These methods have been adopted because of the elimination of many operations, speed of production, and subsequent savings in cost. The long heating operation used in the molding and forming of plastics is unsatisfactory from the standpoint

(*Turn to page* 94, *please*)

HOLLEY CARBURETOR

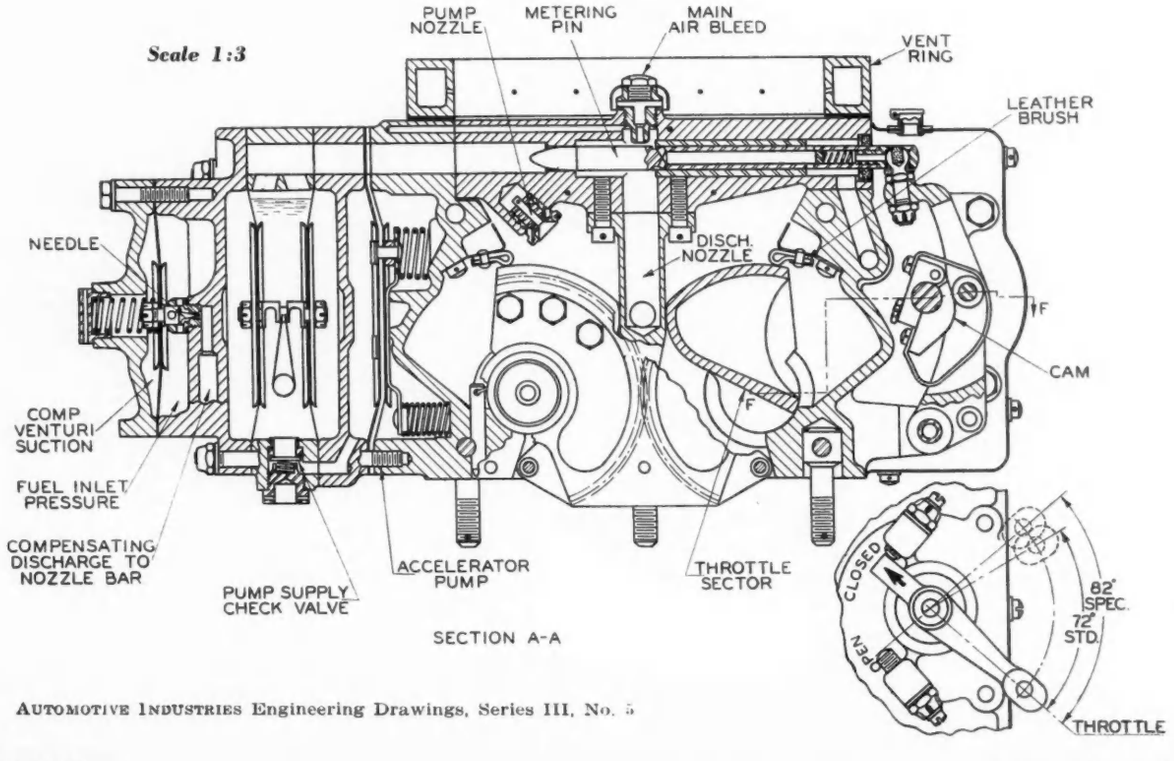
Model CG for Aircraft Engines

THIS carburetor has a single air passage to which fuel is supplied from a single supply chamber as a result of the difference in the pressures in the supply chamber and the throat of the air passage. It differs from most other types of carburetor in that the float mechanism of the conventional supply chamber is replaced by a diaphragm mechanism, and in that the air passage is controlled by a variable venturi instead of by a butterfly valve. The carburetor is said to be inherently free from ordinary icing troubles, owing to the arrangement of the discharge nozzle and the venturi throttles. Partial compensation for changes in altitude is provided by the type of fuel-metering system and throttle used, but to permit of more exact altitude adjustment and increased economy under favorable operating conditions, a manual mixture-ratio control is provided. In the following description, the side of the carburetor on which the throttle and mixture-control levers are located is referred to as the rear side, and in making use of the terms "right" and "left" sides, the carburetor is supposed to be looked at from the rear.

The main body of the carburetor consists of two blocks bolted between two side plates. The two throttles, the metering channel, the discharge nozzle and the throttle shaft are assembled with the main body. The throttles are modified cyclindrical sectors having the discharge nozzle located between them and forming a venturi-like passage for all degrees of opening. The throttles fit in the main body with a small end clearance and are sealed against leakage by means of a leather brush which bears lightly against the cylindrical surface. A gear on each throttle and on the throttle shaft serves to drive them in synchronism.

The main diaphragm is fastened to the left side of the carburetor by means of studs. The mixture-control valve is located in a casting fastened to the rear of the carburetor. Venting of the carburetor is through a hollow rectangular casting which matches the air entrance and is provided with a number of small holes around the inside surface. Drilled passages lead from this vent ring to the space outside the two main fuel diaphragms.

Two similar diaphragms placed side by side form



AUTOMOTIVE INDUSTRIES Engineering Drawings, Series III, No. 5

HOLLEY CARBURETOR—Model CG

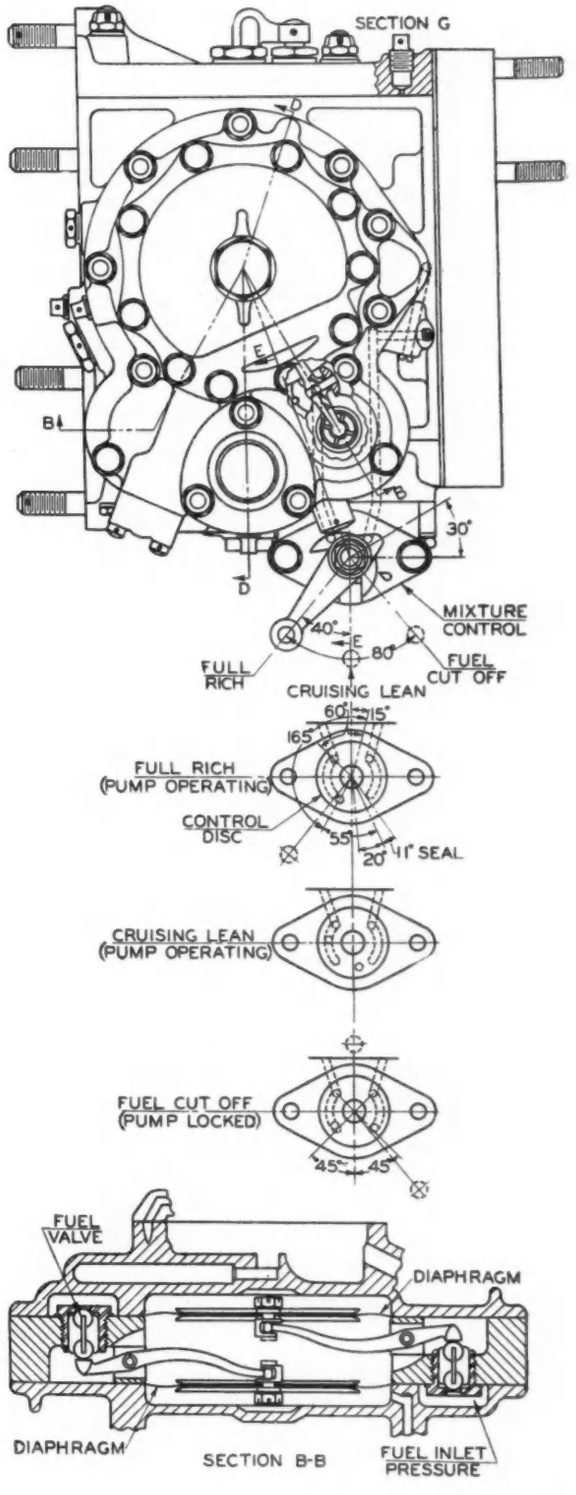
a fuel chamber between them. At its center each diaphragm is flexibly connected to a lever whose other end bears on a fuel valve. This valve is in the form of a ball-ended plunger sliding in a guide which also forms the seat. Fuel is delivered to the chamber through this valve by the fuel pump. The weight of the fuel causes the diaphragms to bulge outwardly, thereby forcing the valves against their seats by means of the levers. When the fuel reaches a certain level in the chamber formed by the diaphragms, its weight exerts enough force on the diaphragms to close the fuel valves against the pump pressure.

The outlet from the fuel chamber is at the top. the suction from the fuel nozzle draws the diaphragms together, which allows the valves to open and admit more fuel, so that as long as the engine is running the diaphragm chamber will be filled with fuel. This eliminates troubles resulting from splashing and consequent interruption in fuel flow during violent maneuvers.

The main metering channel, at the outlet of the main diaphragm mechanism, is provided with a restriction and a tapered metering needle. This needle is actuated through a lever from a cam on a shaft geared to the throttles. The channel and restriction are located in the cross bar above the throttles. As the throttles are opened to increase the air passage, the fuel-passage opening is increased correspondingly, to provide the proper fuel flow. An air bleed at the center of the main metering channel tends to stabilize the fuel flow. Idling adjustment is by means of an additional air bleed in the form of an adjustable valve. This valve bleeds air through a passage in the center of the metering needle which shuts off as soon as the needle has been lifted about 1/16 in., hence it is not effective at speeds above 1000 r.p.m.

To properly enrich the mixture when the engine output approaches the maximum, a venturi is provided in the fuel inlet. When fuel flows through this venturi, the pressure at the throat is less than that at the entrance and the greater rate of fuel flow the greater the difference in pressure between throat and entrance. This pressure difference is used to operate a spring-loaded needle valve. When the pressure differential due to the fuel flow reaches a certain value, this valve begins to open, and an additional quantity of fuel is then supplied directly from the entrance through an external tube at the rear to the compensator discharge nozzle. The tapered needle is secured to a flexible diaphragm and is held against its seat by a spring. The chamber in which the needle and seat are located is connected to the fuel supply ahead of the venturi entrance, the other side of the diaphragm being connected to the throat of the compensator venturi.

The mixture control valve has the effect of applying to the space outside the main diaphragms, a percentage of the suction at the metering needle. This reduces the suction which draws fuel out of the diaphragm

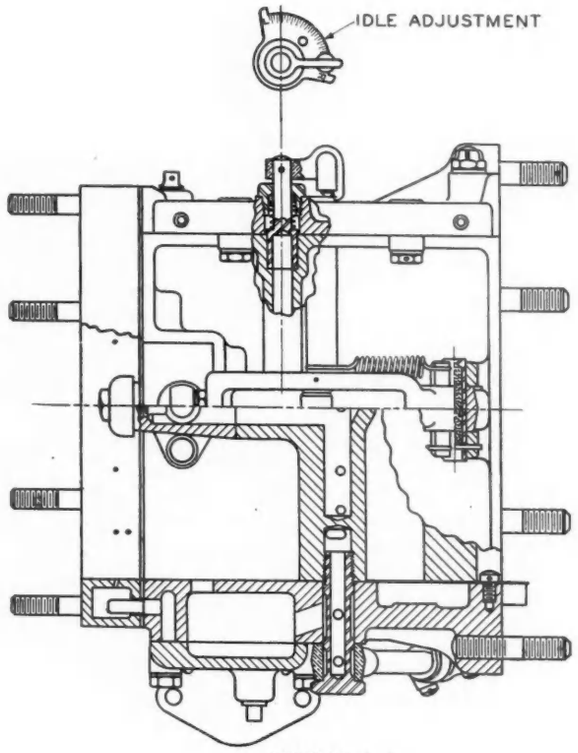


HOLLEY CARBURETOR—Model CG

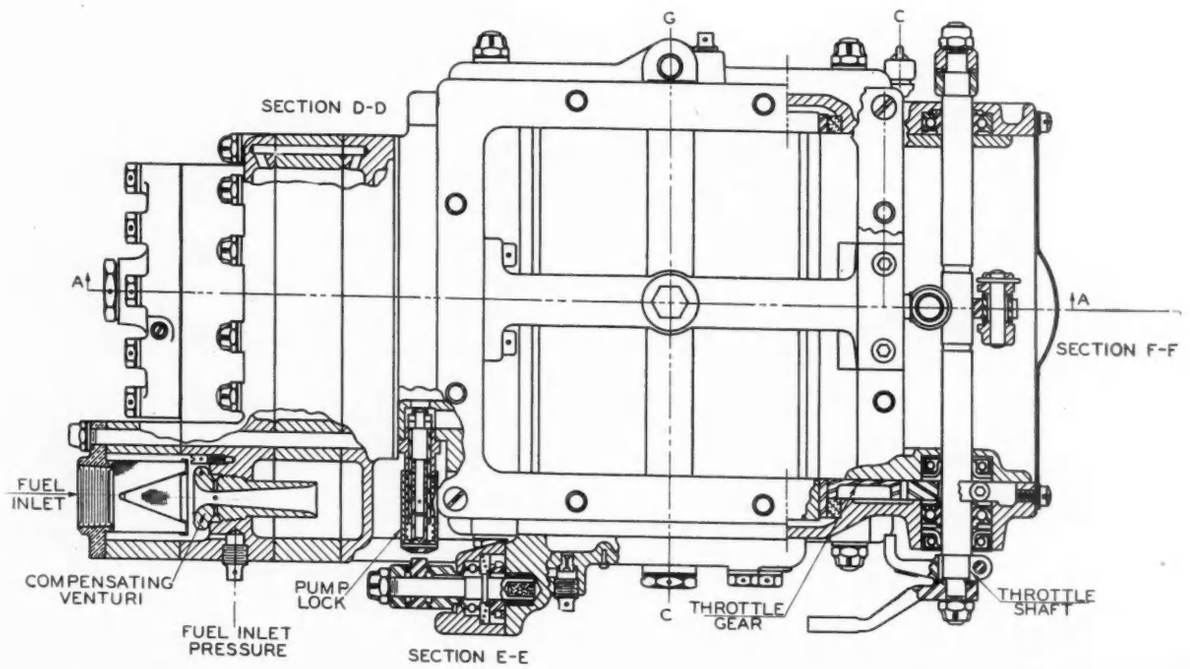
chamber and results in a decreased pressure drop across the fuel-metering restriction, giving decreased fuel flow and resulting in a leaner mixture. The amount of suction is regulated by varying the area of the mixture-control valve passage, which admits the suction to the space outside the diaphragms. In the "full-rich" position this passage is completely closed.

A further function of the mixture control is to shut off the flow of fuel, preventing the engine from "after-firing" when stopped. This is accomplished by moving the mixture control beyond the "cruising lean" stop. This exposes the outside of the diaphragms to practically the same suction as that existing at the fuel-metering restriction, and at the same time locks the accelerating pump. With the suction thus balanced, the diaphragms close the fuel inlet valves so that the fuel supply is cut off completely.

A vacuum-operated diaphragm-type of accelerating pump is provided, and is located between the main diaphragm mechanism and the body of the carburetor. The pump comprises an inlet check valve, an outlet spray nozzle, a diaphragm, three springs for moving it, and the pump lock valve. One side of the diaphragm is under the influence of the vacuum created when the throttles are closed and the engine is running, while the other side together with the inner wall of the main diaphragm mechanism forms a gasoline chamber. When the engine is idling, the high vacuum below the throttles pulls the pump diaphragms against the springs and draws a charge of fuel into the pump chamber through the inlet check valve. When the throttles are opened, this vacuum is broken and the springs force the fuel out of the pump chamber through the spray nozzle.



SECTION C-C



Engine Combustion Research

T. A. Boyd of G.M. Research Laboratories Division gave a review of a long research on engine combustion carried out in the General Motors laboratories, principally by Lloyd Withrow and Gerald M. Rassweiler. *The investigation was concerned chiefly with knock, but an extension of knowledge of knock-free combustion also was aimed at.

In recent work, series of 30 successive photographs were obtained of a single combustion in a cylinder provided with a cylinder head containing a quartz window which exposed every part of the combustion chamber

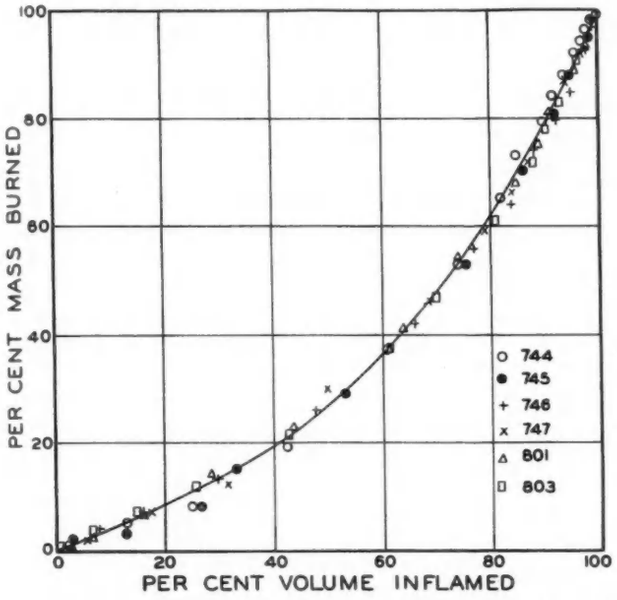


Fig. 1.—How volume inflamed relates to mass burned

to view, showing the spark plug, the valves, and the piston top. A special high-speed camera was built, 30 matched lenses being mounted 2.4 deg. apart along a sector of the circumference of a large disk carried by the crankshaft. With this arrangement it was possible to take pictures at the rate of 2500 per second with the crankshaft rotating at 1000 r.p.m., and 5000 per second with the crankshaft rotating at 2000 r.p.m.

One of the objects aimed at in getting 30 successive pictures of a single explosion was to determine the relationships existing between the essential engine factors, such as that between volume inflamed and mass burned, and that between mass burned and pressure developed. An accurate pressure diagram was taken from the engine at the same time the pictures were being taken. It has been possible to derive a definite relationship between the fraction of the volume burned and the mass of charge burned, and this relationship for a series of representative explosions is shown in Fig. 1. This shows that when the flame had filled 50 per cent of the chamber volume, only about 25 per cent of the mass of the charge had been burned; and that when 75 per cent of the chamber volume was filled with flame, about 50 per cent of the mass was burned.

Fig. 2 shows how closely the percentage of mass burned is related to the percentage of pressure rise due to combustion when—as was done here—account is taken of the change in volume due to piston motion during the period of combustion. The curve plainly shows how very slow the rate of reaction is during the first one-fourth of the combustion period, less than 5 per cent of the charge burning during this period even under favorable conditions.

The three plots in Fig. 3 show the influences on the rate of combustion of changes in the location of the spark gap, in the air/fuel ratio, and in the relative throttle opening, as determined from flame pictures and pressure records obtained in this research. In each of the three plots the percentage mass burned is plotted against time or crank angle. Plot A shows how much faster the charge burns when it is ignited at the center of the combustion space than when it is fired at the end. In this particular case the difference in the over-all time is about 8 deg. of crank angle. The curves of plot B show that a 19:1 mixture took 12 deg. of crank angle longer to burn than a 13:1 mixture, the latter being that giving maximum power. With the lean mixture it took nearly twice the normal time to burn an appreciable part of the charge, and the maximum rate of combustion was about 25 per cent less in the case of the lean than in that of the maximum-power mixture. Plot C is a comparison of the rate of combustion at full throttle with that at a throttle setting giving about 45 per cent of full engine power. At part throttle the maximum rate of combustion was only about one half as great as at full throttle, and the period of combustion was about 50 per cent longer.

As shown by Fig. 2, the percentage of the mass of

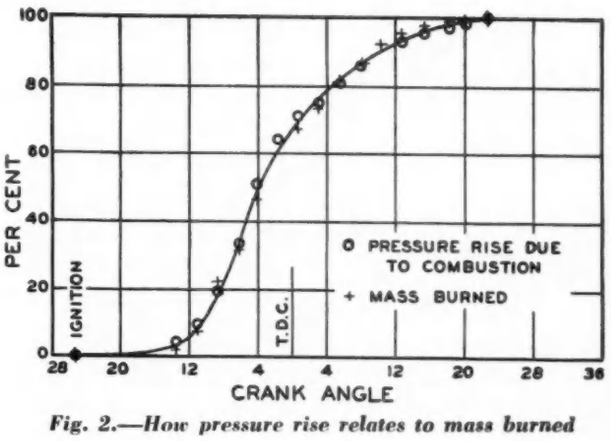


Fig. 2.—How pressure rise relates to mass burned

RESEARCH

* A paper presented at the World Automotive Engineering Congress.

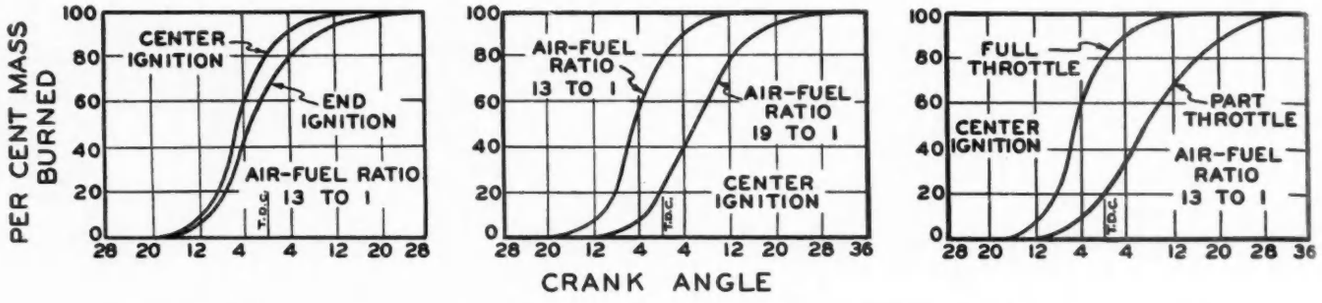


Fig. 3—Influence upon rate of combustion of changes in point of ignition, in air-fuel ratios and in degree of throttle opening

charge burned at any given crank angle is approximately equal to the percentage pressure rise due to the combustion. Hence the curves of Fig. 3 also show with a fair degree of accuracy the percentage of pressure rise due to combustion at the various crank angles for the different conditions involved.

Since there is a definite relationship between volume inflamed and mass burned, and between mass burned and pressure developed, if accurate pressure cards are available, the essential relationships which have been established in this research can be derived directly from the pressure cards, without the use of flame pictures. Fig. 4 shows how volume inflamed as derived from pressure cards relates to that observed directly by means of the flame pictures. The maximum difference between the values obtained by the two methods—which occurs at the middle points—is about 8 per cent.

Thus one result of these researches has been to show how valuable a precise pressure indicator can be in the study of combustion events, and how to use it to determine such factors as the volume inflamed and the mass burned at any instant.

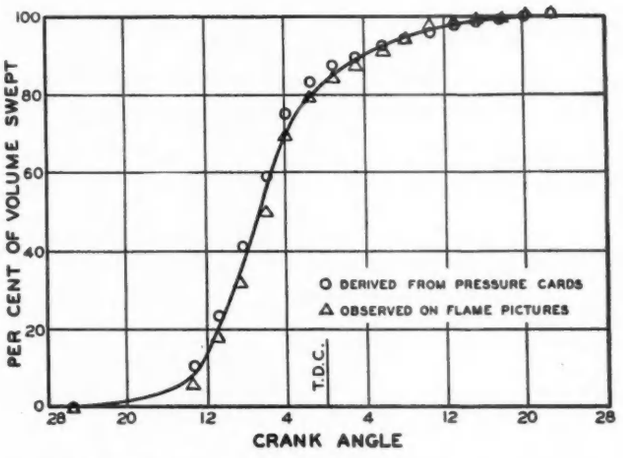


Fig. 4.—How percentage volume inflamed as derived from pressure cards relates to that derived directly from flame pictures.

A Two Stroke Air-Cooled Engine for Planes

A TWO-STROKE air-cooled engine for light airplanes has been designed by C. F. Caunter of Salisbury Road, Farnborough, Hants, England, who has been specializing on two-stroke engines for more than ten years. The new type C engine has four cylinders of 3.23 in. bore and 3.94 in. stroke and is said to develop a maximum of 60 hp. at 2700 r.p.m., while its cruising output is 50 hp. at 2400 r.p.m. The weight of the engine is 120 lb. The fuel consumption is given as 3¼ Imp. gallons per hour and the oil consumption as one pint per hour. This fuel consumption at an output of 50 hp. is very low for a two-stroke engine and is said to be made possible by the high compression ratio permitted by the special cylinder design.

The crankcase consists of two magnesium-alloy castings which are held together by 16 cylinder-holding "through" bolts. There is a separate compartment in the crankcase for each cylinder. The crankshaft is of the built-up type and is supported in one ball thrust and eight light roller bearings. Sealing devices incorporated with the crankshaft bearings maintain crankcase compression. Connecting rods are solid steel forgings and have double-track roller bearings at the big end and a bronze bushing in the small end.

The cylinder is a one-piece light-alloy casting provided with deep, finely-pitched fins. It is unlined, and the flat-top pistons bear directly on the bore in the light-alloy. This construction improves the heat flow and permits of the use of a compression ratio of 10 with normal gasoline of 73 to 77 octane. A phosphor-bronze adapter is screwed into each side of the cylinder head to receive the 14-mm. spark plugs.

Mixture is supplied by a single Zenith downdraft carburetor to an intake manifold cast of magnesium alloy. Dual ignition is provided by two B.T.H. four-pole magnetos running at engine speed and mounted in cradles formed integral with the top half of the crankcase. Automatic timing devices are incorporated in the magnetos. Provision is made for the fitting of an Amal fuel pump on each side of the accessories-drive housing. Magnetos, fuel pumps, oil pump, tachometer, etc. are driven through a train of three spur gears from a pinion on the rear end of the crankshaft. There is provision also for mounting either an electric starter or a generator.

Mr. Caunter figures that when produced in quantity the engine could be retailed at £80 ($375 at the current rate of exchange).

AUTOMOTIVE INDUSTRIES

Just among Ourselves

ADVENTURING by automobile, that is to say adventuring in the grand tradition, still has a few devotees. So far as the newspaper headlines are concerned, the airplane has all the best of it. There is probably not a newspaper left in the world which would devote many columns of space to an account of a traverse of Africa by automobile. The automobile is commonplace. Anyone can drive it, and the adventures of the road are little, commonplace matters that we now take for granted.

The English, of course, take their "motoring" a little more seriously as a sport than we do. To them "motoring" means anything from a Sunday drive into the Cotswolds, to a turn around the track at Brooklands at 120 m.p.h. It also includes such activities as participation in the Monte Carlo Rallye or a little jaunt across Africa.

To a couple of Englishmen, H. E. Symon and H. B. Browning, it meant a journey of 10,300 miles from London to Capetown—in 31 days and 22 hours. The account of this remarkable journey is contained (with some grand pictures) in a brochure titled "Cape Record" written by Mr. Symons, who thereby becomes entitled to join the company of English chroniclers star-studded through the centuries with names like Hakluyt and Purchas. The journey was some sort of record, which seemed very important to the participants. Averaging something like 320 miles a day on a journey like that is a test of physical stamina for men and car which make some of the proving ground tortures seem significant.

The car used by Messrs. Symons and Browning was a Wolseley. It contained some special equipment designed to ease the journey, but there were no changes in the basic structure. Dunlop 9 in. tires were mounted on all wheels and a 40 gallon gasoline tank was built into the space usually occupied by the rear seat.

Weather conditions on the journey varied from deep snow to steaming jungle heat. Every kind of road surface known to civilization and many kinds which most of us are blessedly unfamiliar with, were encountered.

At one point on the journey the car swerved through the rails of a wooden bridge and dropped more than 30 ft. into the waters of the River Gada. Retrieved by a crew of blacks, it was repaired by Egyptian mechanics in the Sudan and again proceeded on its way.

Mr. Symon's account of the journey is rich reading. If you like that sort of thing drop a line to Morris Industries Exports, Ltd., Cowley, Oxford, England, and ask for a copy of "Cape Record." Can't promise results, but you'll be well rewarded if they come through.

Sound Anywhere

Over the entrance to the Coventry Motor Mart, Ltd., of Coventry, England, there appears a large sign which reads "There will be no war! Buy now—enjoy life and keep the old world turning." The first part of the statement is open to grave doubt. The clipping which illustrated the sign arrived on my desk on the same day as the American newspapers were getting excited about Great Britain's territorial-army mobilization scheduled for August.

With the second part of the statement we find no quarrel. To us it's sound doctrine with or without the imminence of war. To W. J. Lord, managing director of the Coventry Motor Mart, congratulations for the blazoning of a sturdy attitude.

A Loss...

For more than 20 years, news from the Milwaukee region appearing in AUTOMOTIVE INDUSTRIES has been made into copy by the capable hands of Leonard E. Meyer. A note from his brother this morning tells of Mr. Meyer's death of a heart attack.

He was an active figure in Wisconsin journalism and in the Masonic order. He helped organize the Milwaukee Automobile Club and was its first secretary. He was a good and useful citizen of his town. His news copy was always terse, always accurate.

He was a fine representative of a sizeable group of able and devoted correspondents of this magazine, some of whom we have never seen, but who continue, year after year to interpret the happenings within their knowledge for our readers.

When you handle a man's factual "copy" for 10 years you get a pretty good idea of his integrity. Mr. Meyer had It.

Anti-Pack Campaign

The Pennsylvania Automotive Association has implemented a vigorous anti-pack campaign, designed to eliminate unwarranted additions to financing and insurance charges on the retail sale of motor vehicles. Enforcing agency in Philadelphia, selected as a test area, will be the Better Business Bureau. Now in its initial stages, the campaign will bear watching by everyone interested in the sale of cars and trucks.

—HERBERT HOSKING.

Ford Makes A New

OFFICIAL announcement of the new Ford farm tractor was made at Dearborn, Mich., on June 29, when a demonstration was given on the estate of Mr. Ford before representatives of the press, and agricultural and business leaders. It is a small tractor, of two-plow rating, and it incorporates the Ferguson system of hydraulic controls for the unit implements. By means of this system, not only can the implements be lifted out of the ground without physical effort, but the depth of cultivation can be closely controlled regardless of surface irregularities. Owing to the combination of tractor and tools in a single unit with a low center of gravity, the tractor is said to perform unusually well on hills. The point of attachment to the tractor is such that the implement pull increases the pressure of the front wheels on the ground, so that steering remains positive even on very steep up-grades. Another effect of this arrangement of the hitch is said to be that if the tractor strikes an obstruction, the pressure of the rear wheels on the ground is automatically relieved, and these wheels begin to spin.

In addition to the line of plows now available, purchasers are offered a row cultivator which can be fitted with different kinds of shovels, and a general cultivator, which can be adapted to different uses on the farm. The tines of the general cultivator are of such shape that when an obstruction is encountered, they automatically ride over it, and they enter the ground again without the tractor being stopped or the implement raised by hand. The row-crop cultivator can be quickly attached without the use of tools, and the tread of the tractor can be adjusted for different widths of rows between limits of 48 and 76 in., in 4-in. steps. The cultivator is provided with a fin which tends to keep it running in a true path, thus preventing damage to crops.

The hydraulic control unit comprises a four-cylinder pump which delivers oil under pressure to a ram cylinder. A handle located convenient to the operator's right hand gives him control of the implement, the handle being connected to the control valve of the hydraulic system.

Owing to the close coupling of the implement to the tractor, the combination can be used conveniently to work small irregular plots of land. This was demonstrated at Dearborn on an enclosure measuring 20 by 27 ft., which was completely tilled without leaving wheel marks on the surface.

The new Ford tractor has a four-cylinder L-head engine of 3.18-in. bore by 3.75-in. stroke (120 cu. in.) that develops 23 hp. at 1400 r.p.m.—the speed recommended for plowing. It is fitted with a governor that can be set from the steering column to limit the engine speed to anywhere between 1200 and 2200 r.p.m.

The carburetor is of the plain-tube, up-draft type. It draws in air through an air cleaner of the oil-bath type, with a dust receptacle removable for cleaning. Ignition is by a direct-driven distributor with automatic advance, which is combined with the coil in a water-proof housing. Lubrication is by force feed, from a gear-type pump, to all crankshaft, camshaft, and connecting-rod bearings, and to the timing gears. The crankcase has an oil capacity of 6 quarts. An oil filter of the removable-cartridge type is supplied. Cooling water is circulated by a pump of the packless

Tractor and Implements

type, with pre-lubricated bearings, through a tube-and-fin type radiator with 16-in. belt-driven fan.

Fuel is carried in a welded-steel tank under the engine hood, with a capacity of 9 gals. and a one-gallon reserve. On the way to the carburetor the fuel passes through a glass sediment chamber and strainer.

The electrical equipment comprises a 6-volt, shunt-wound generator with vibrator voltage control, an electric starter controlled by a finger-operated switch on the dash, and a 13-plate battery of 85 amp-hrs. capacity.

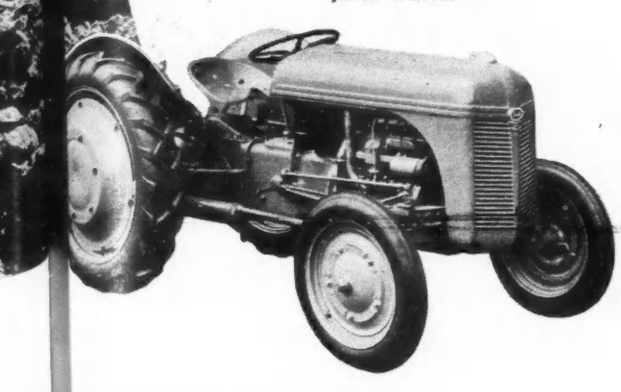
A muffler is fitted, and the exhaust is discharged at the rear of the tractor.

A Few Details

Four-cylinder L-head engine
Horsepower, 23 at 1400 r.p.m.
Displacement, 120 cu. in.
Forward speeds, 2½, 3¼ and 6 m.p.h.
Reverse speed, 2¾ m.p.h.
Overall length, 115 in.
Overall width, 64 in.
Height, 52 in.

Price F. O. B. Detroit $585 plus taxes if any

Two views of the new Ford farm tractor



The clutch is of the single-plate, dry type, of 9 in. diameter, and embodies the semi-centrifugal feature. The transmission, which gives three forward speeds and one reverse, has all shafts mounted on taper roller bearings. At the normal engine speed of 1400 r.p.m. the forward speeds are 2½, 3¼, and 6 m.p.h., while the reverse speed is 2¾ m.p.h.

Steering is through a mechanism comprising a bevel pinion and twin bevel sectors, the two front wheels being steered independently. Adjustment of the front tread does not disturb the steering mechanism. The steering wheel, 18 in. in diameter, is rubber covered.

Two-shoe, internal, self-energizing brakes act independently on the two rear wheels, each brake being controlled by a separate pedal, to facilitate making short turns. The brake dimensions are 14 by 2 in. There is a single accessible adjustment on these brakes.

A power take-off shaft extends rearward from the axle housing. It has a standard-spline end for fittings of drives to power-driven equipment.

All wheels are of the steel-disc type. Fronts are fitted with single-rib 19 by 4-in. pneumatic tires on drop-center rims, which are inflated to 28 lb. per sq. in. Rear wheels carry 32 by 8-in. traction tread pneumatic tires on drop-center rims, inflated to 12 lb. per sq. in.

The new Ford tractor has a wheelbase of 70 in., a normal tread of 48 in. at both front and rear, overall dimensions of 115 in. (length), 64 in. (width), and 52 in. (height), ground clearance of 13 in. at the center and 21 in. under the axles, and a minimum turning circle (with the use of brakes) of 15 ft.

Extra equipment offered includes a belt pulley, a lighting system, and steel wheels with lugs. The belt pulley, carried by a self-contained drive unit, can be quickly attached to the rear of the tractor. The pulley is of 8 in. diameter and 6.5 in. face width, and turns at 727 r.p.m. (2800 ft. per min. belt speed) at 2200 r.p.m. of the engine.

Production of tractors and implements is now getting under way at the Rouge plant of the Ford Motor Company, and deliveries are expected to begin shortly.

Sales and distribution will be handled by the Ferguson-Sherman Manufacturing Corp., Dearborn, Mich.

The list price of the tractor is $585, delivered at Detroit, taxes (if any) extra. Standard equipment includes rubber tires, battery and generator, self-starter, governor, oil-bath air cleaner, muffler, power take-off. Ferguson system of hydraulic controls for all implements, radiator grille, fenders, instrument board, ignition lock, throttle control, and independent brakes on rear wheels. The two-bottom, 14-in. Ferguson unit plow lists at $85, delivered at Detroit.

MEN and MACHINES . . .

Mr. Armour and His Associates

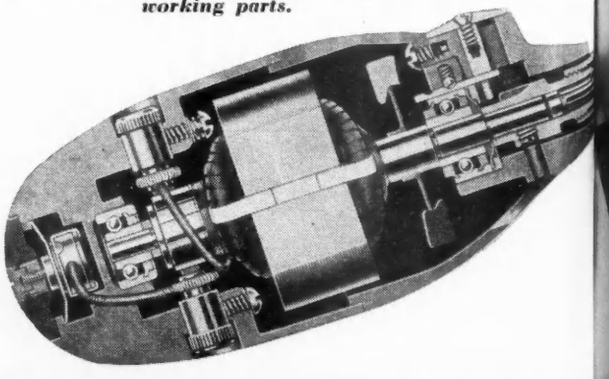
INASMUCH as discussion of materials is featured in this issue of AUTOMOTIVE INDUSTRIES, it seems especially appropriate that we report in *Men and Machines* some highly instructive data on making steels free machining which were contained in a paper presented recently by J. D. Armour, chief metallurgist, Union Drawn Steel Div., Republic Steel Corp.

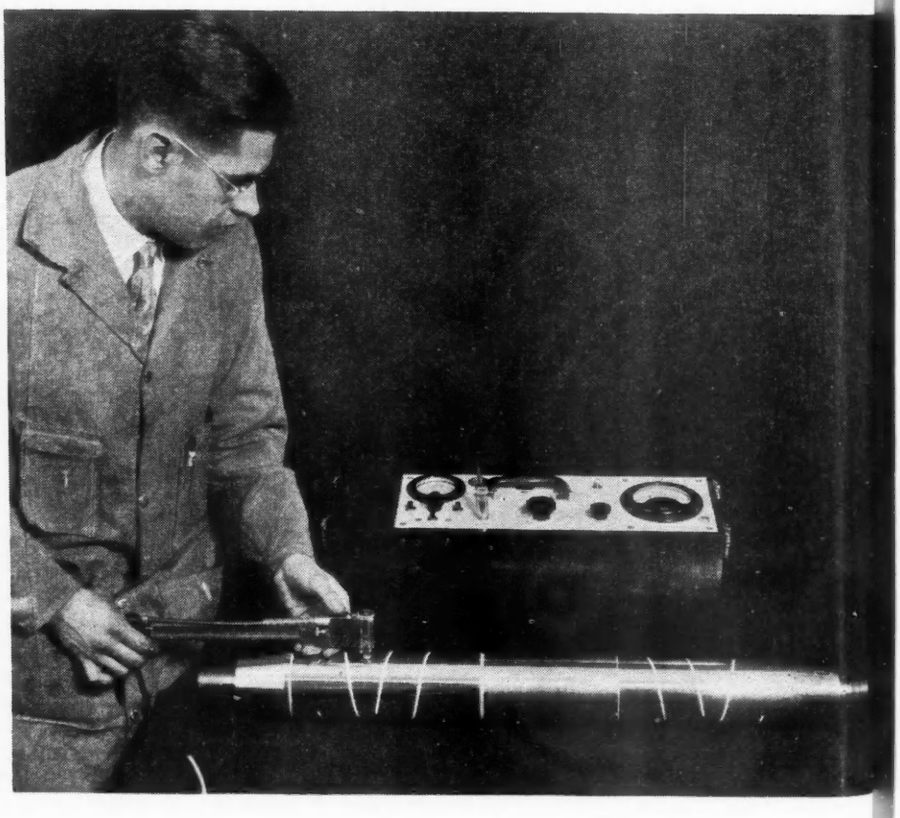
By making special laboratory tests, studying regular production operations in automatic screw machine plants, and correlating all data obtained with metallographic investigations, Mr. Armour and his associates evolved several theories on what makes steel machine freely. From much careful work of this sort came the principal theory that the qualities of steel that make it free machining are low strength, low ductility, and the presence of some constituent to break up the continuity of the ferrite. Low strength is stipulated because less power will be necessary for the cutting tool to tear the metal apart; low ductility so that the chip will break away more readily once the cutting action is started; and the presence of some constituent to break up the continuity of the ferrite and give it support so that the tool will be able to cut from one inclusion to the next instead of cutting its way through an unbroken mass.

With regard to the effect of the common elements in carbon steels on the machining properties, the paper points out that low carbon steels with carbon under 0.10 are notoriously poor machining. Machinability increases with increase in carbon but after 0.30 carbon is passed it starts to decrease. This is explained, according to the theory, on the basis that with increasing carbon content the tensile strength increases and the ductility decreases. As carbon increases up to about 0.30 carbon, the decrease in ductility aids machinability more than the increased strength retards it. In the neighborhood of 0.30 carbon, however, the factor of increasing strength begins to outweigh the benefits of decreasing ductility with the result that the higher the carbon beyond this point, the poorer the machining properties.

Manganese and phosphorous also increase the

Cross-sectional view of hand grinder built by Duro Metal Products Co., Chicago. The device is powered by a General Electric universal motor developing over 40 watts output and running 24,000 r.p.m. A propeller type fan pulls a large volume of air over the working parts.

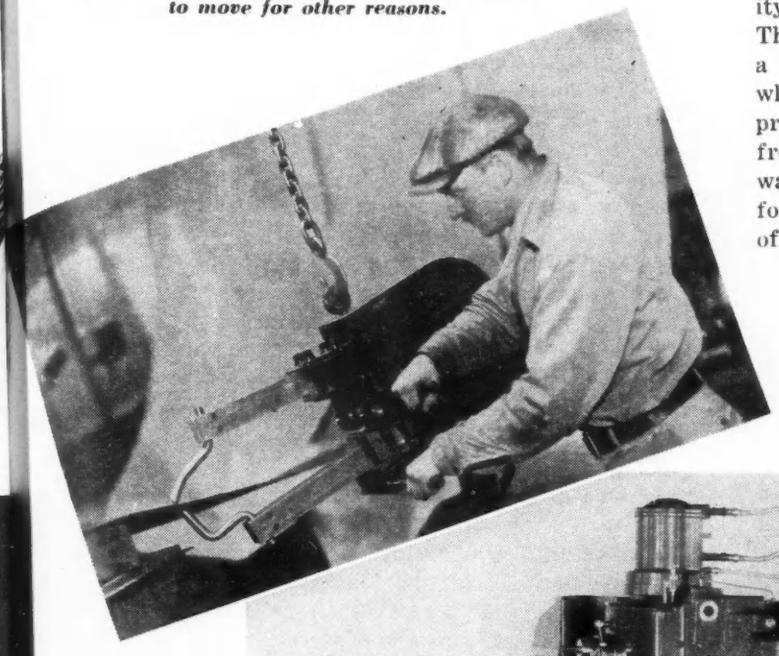




The journals of a 10 in. Type C Norton wheelspindle being inspected for surface finish using a Profilometer.

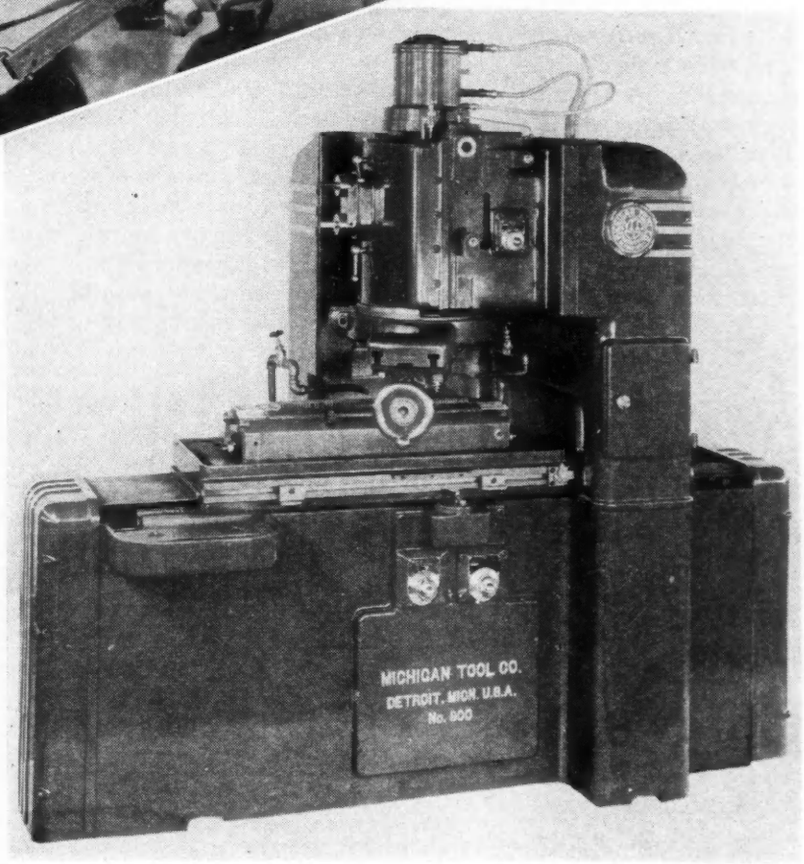
Evolved Several Theories On What Makes Steel Machine Freely

The Electric Arc Cutting & Welding Co., Newark, N. J., recently brought out the spot welder, shown herewith, wherein the welding head, control and automatic switch are in a compact unit, arranged to be hung from a trolley or portable crane to handle work that is clamped to a form or jig or not practical to move for other reasons.



strength and decrease the ductility of steel, and a similar effect on machining properties is observed. In the case of sulfur it is necessary to drop the strength-ductility phase of the theory inasmuch as sulfur has little effect on either the tensile strength or the ductility in the same sense that carbon or manganese do. The effect of sulfur is due to the fact that it forms a multitude of small inclusions of manganese sulfide which support the ferrite when it is subjected to the pressure of the cutting tool and allow the tool to cut from one inclusion to the next instead of forcing its way through the solid ferrite. No evidence has been found that silicon improves the machining properties of steel under any conditions.

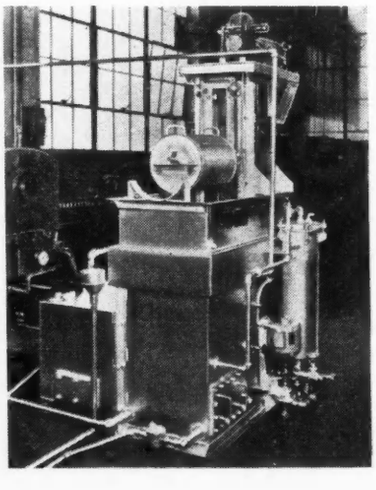
There are many other factors aside from chemistry that affect machinability. It is traditional that screw stocks should be finished hot to produce the best machining properties, and the principal benefit of this high finishing temperature is in producing a coarser as-rolled grain structure. This is consistent with the theory of machinability advanced in the paper under discussion inasmuch as coarse grained material has lower strength and lower ductility than finer grained. Further, it is suggested that inherent or McQuaid-Ehn grain size, has no direct effect on the machinability of the steel since fine grained McQuaid-Ehn steels can have a coarse grained as-rolled structure if finished on the hot mill at the proper temperature.



Completely hydraulically operated, heavy-duty, high production gear finisher built by the Michigan Tool Co., Detroit. The machine is designated as model 900.

Most important factor in the machinability of free-cutting steels aside from chemistry, however, is the effect of cold working. Cold working increases the strength and decreases the ductility of steel. Also, cold working is similar to manganese and phosphorous in that it embrittles the ferrite which is held to be the preferable way of reducing ductility. With the normal amount of draft used in cold drawing, the tensile strength is increased about 30 per cent while the ductility, as measured by the elongation in 2 in. in a tensile test, is reduced about 50 to 60 per cent. According to the theory, therefore, this should be a very favorable method of improving the machinability and such is found to be the case. Other interesting features of the mechanism of cold working which play an important part in improving machinability are discussed in the paper.

While the low sulfur plain carbon steels and the alloy steels cannot be machined at speeds and feeds comparable to the re-sulfurized or so-called free machining steels, they may be classified as free machining or poor machining depending on whether or not they can be machined at better than average feeds and speeds for that particular grade with satisfactory tool life and finish. As carbon or manganese or both are increased in the low sulfur plain carbon steels, there is first an improvement, then a drop in machining properties as the strength factor begins to outweigh the ductility factor. Just how far carbon and manganese can increase before it becomes economical to resort to thermal treatments to improve machinability will depend on the practice used in hot working or cold working and the type and amount of machining that is to be done. When thermal treatments are resorted to for the purpose of improving machinability, in the medium carbon steels, they should be designed to coarsen the grain, break up the continuity of the ferrite as much as possible, and put the carbon in the lamellar pearlite form. It was found in the research work under discussion that when about 0.50 carbon is reached, with this type of structure, the strength factor again becomes too high for best machinability, and it is necessary to modify the annealing cycle so that just sufficient carbide will be changed to the spheroidized form to keep the strength factor in the best machining range which will be somewhere in the neighborhood of 100,000 lb. per sq. in. tensile strength, or about 200 Brinell hardness.



Detrex degreaser of the Detroit Rex Products Co. and described on page 79

While the same general principles apply in the case of alloy steels, there are other factors which must be considered. Alloys may be either carbide forming, such as vanadium, solid solution forming, such as nickel, or the same alloy may be both at the same time, such as chromium and manganese. Carbide forming alloys present no particular difficulties in producing good machining properties in alloy steels. The solid solution alloys, however, present quite a different problem. They toughen and strengthen the ferrite and therefore their tendency is to retard machinability. While there is little that can be accomplished by thermal treatments to improve the machining characteristics of the ferrite in the solid solution alloy steels, machinability can be materially improved by cold working the ferrite to reduce the ductility.

In concluding his remarks on the subject, Mr. Armour states that "Improvement in machining properties has resulted largely from a better understanding of the underlying principles. The extent of this progress can perhaps most readily be appreciated by comparing the feeds, speeds, and production on some of the automatic screw machines of 10 or 15 years ago with similar parts today. The average increase in production would probably be in the neighborhood of 100 per cent. The demand in the future for further improvement in machinability will no doubt be just as insistent as it has been in the past, and if this improvement is to be realized, it will be because of a still better understanding of the underlying principles."

Among the new developments in machine tools and related equipment brought to the attention of *Men and Machines* in recent weeks one of the most interesting is a completely hydraulically operated, heavy-duty, high-production gear finisher. In this machine, which has been added to the Michigan Tool Co.'s line and is designated as model 900, a gear is cut by serrated cutters in a reciprocating horizontal rack with which the gear is meshed by feeding the work carrying head downward to the rack. Relation between gear axis and cutter is such as to provide a diagonal relative motion of the gear faces across the serrations in the rack blades while the rack is rolling the gear. Cross-feed is designed so as to reciprocate the gear across the rack at a constant but adjustable speed. Length of stroke across the rack and the transverse portion of the rack over which the gear is reciprocated also are adjustable.

Cutting feed is adjustable by a single valve from 0.0005 in. to 0.0025 in. per cycle of the table. A dial setting is provided to stop the rack automatically after the desired number of finishing strokes, and the head then raises automatically through a rapid return.

In the coolant system an interesting combination reservoir and coolant cleaning tank has been worked out. This comprises six separate compartments in series, each having individual drain pipes. Coolant flows into the first compartment through a strainer, then over baffles into consecutive compartments, providing for progressive deposition of foreign matter. The fifth compartment is filled with steel wool for final filtering. The machine is designed to finish gears up to 8 in. diameter, with maximum length between centers of 18½ in.

Improvements in the visor type of eyeshield made by the Jackson Electrode Holder Co., Detroit, include a

metal binding to stiffen the edge of the transparent visor and a fiber spark deflector guard which protects the opening between visor and forehead without checking ventilation. The visor will not ignite spontaneously, is non-fogging, and hot metal will roll from it.

Just recently the Norton Co., Worcester, Mass., announced that all grinding machines of its manufacture would be built with kerosene lubrication of the grinding wheel spindle. Since Dec. 1, 1936, tests have been underway, both in the Norton experimental laboratory and in the field, from which considerable data and interesting results have been obtained. Among the latter is the finishing of spindle journals to a highly reflective mirror-like surface, accurate in size and straightness to 0.0001 in. and reading from one to two microinches on the Profilometer.

While kerosene has been used for many years as a spindle lubricant in high-speed internal spindles supplied with Norton tool and cutter grinders, a high quality oil with a Saybolt viscosity rating of from 60 to 185 at 100 deg. F. was employed for external grinding spindles. These operate at speeds ranging from around 800 to 1800 r.p.m., depending on the grinding wheel diameter. From 0.001 in. to 0.002 in. clearance for oil was provided in the bearings and a bearing temperature of about 140 deg. F. was considered normal. Tests are reported to show that the increase in lubricant temperature was 9.4 per cent over room temperature with kerosene, and with oil under the same conditions an increase of from 68 per cent to 73.5 per cent.

(*Turn to page 79, please*)

Production Lines . . . .

Steps Up

Current survey by Ethyl Gasoline Corp., indicates that the national average octane rating of regular gasolines is around 71.7, an increase of more than a full octane number over last year, and more than double the normal increase during the past few years. We learn, confidentially, that several national marketers are beginning to distribute regular grades rated around 74 octane. In this connection, it is of interest to find that a few of the small refiners with sectional distribution facilities have been marketing a 74 octane regular gasoline for some time. Meanwhile the premium grades have been stepping up, the national average being above 78 octane, and a number of producers with 80 octane. So far as we can observe, these statistics may be interpreted to mean that the way is clear for at least moderate increases in compression ratio for the '40 cars.

Active Sulfur

Active sulfur is all right in its place. It's an asset in certain types of cutting fluids. However, when you find it in certain Diesel fuels or at least the kind of material that is sometimes offered as a Diesel fuel, it creates serious difficulty. One of the principal speakers at the recent Oil and Gas Power Conference in Ann Arbor made a point of the fact that some users of their Diesel engines were having trouble due to active sulfur. The sulfur reacts with the surface of copper fuel lines, forming copper sulfides, which have a way of disturbing the closely fitting parts of a Diesel fuel distributing system. The only solution is to educate the operators to buy fuels that meet minimum specifications.

Absorbs Shocks

A new and interesting device for absorbing road shock and impulses due to torque reaction and braking is being demonstrated by its inventor. Essentially, it is a novel form of cushion wheel principle applied to motor car wheel construction. We have promised to say no more for the time being.

Tell Them

Much has been accomplished in recent years through close cooperation between the automotive industry and its hand-in-glove partner, the petroleum industry. We need but a modest step further in this direction. Upon reflection it is easy to see how serious a matter it is for a refinery to change its practice radically to meet new requirements for fuels and lubes. Not that refiners are unwilling to progress. The real problem is the length of time it takes to make a changeover. For this reason, much good could be accomplished in the mutual interest of everyone concerned if the refiners were given an opportunity to appraise new mechanical designs in their embryonic stages. It is even possible that a good lubrication man could, on occasion, make suggestions that would smooth the way later on.

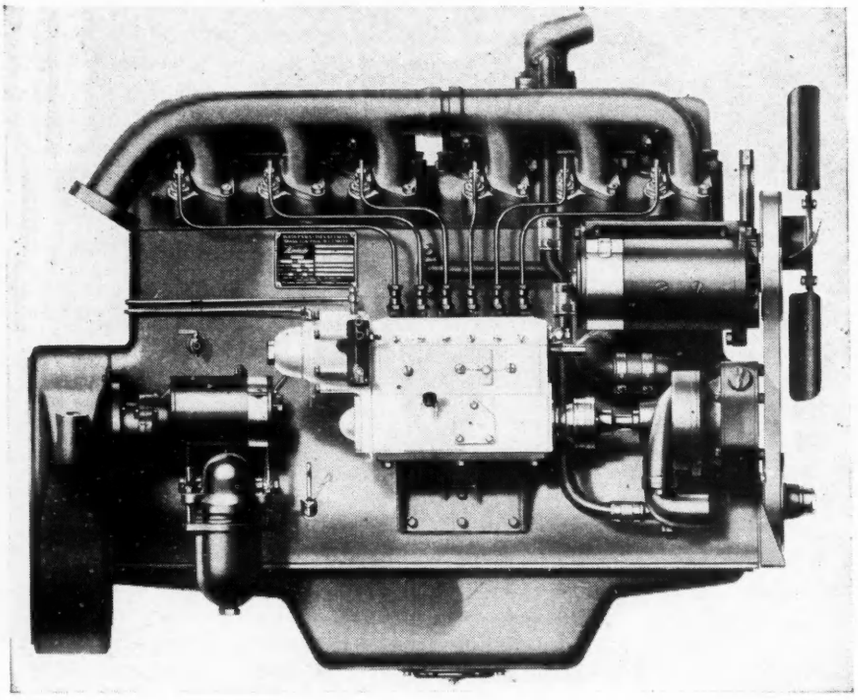
Spot Welds

Resistance welding has been fast developing into one of the few major production techniques in the automotive industry with an art that touches many hitherto unexplored avenues. Fact is it's important right now to promote a still better utilization of the art by the introduction of standards for spot welding, encompassing such details as—criteria of strength, sampling techniques for quality control, values for ratio of spot diameter to metal thickness, etc. Too much diligence cannot be shown by the technical committees in making this information available to the industry.

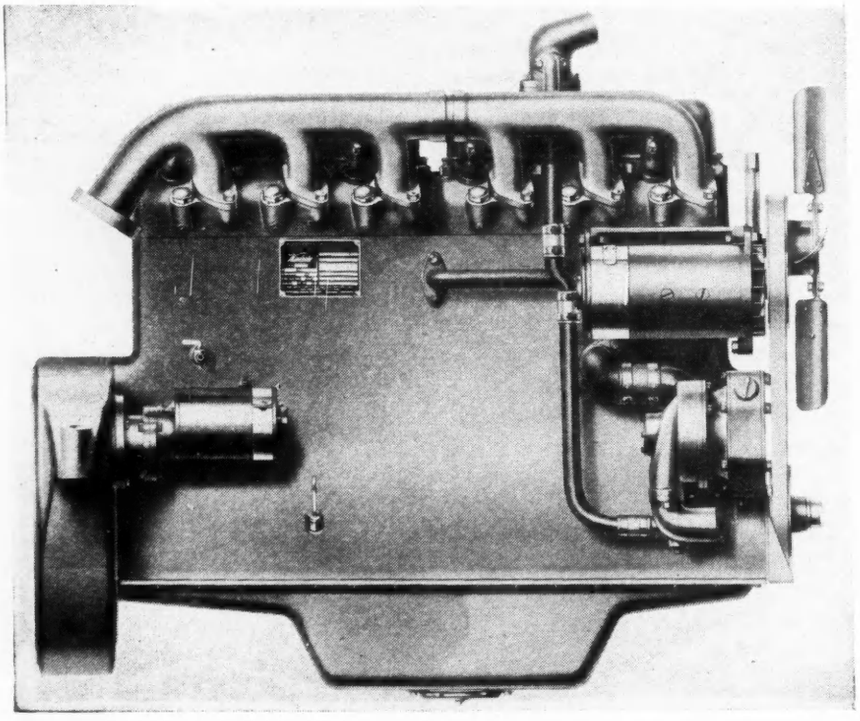
On Additives

A new bulletin describing the current series of Alox additives and bases for petroleum products has just reached our desk. It covers specifications and characteristics of each compound, succinctly but comprehensively. We commend it to chemists, metallurgists and others interested in lubrication.—J.G.

Waukesha Develops a



Pump side of 140 Series Waukesha Multi-Fuel Poly-Cycle Engine arranged for fuel oil



140 Series Waukesha Multi-Fuel Poly-Cycle Engine arranged for gasoline operation. Notice the omission of fuel injection apparatus and substitution of screw plugs for fuel nozzles.

AS ALREADY announced in these columns, Waukesha Motor Company is developing a series of what it calls multi-fuel, poly-cycle engines which, with suitable accessory equipment, can be operated as oil engines, gasoline engines, or gas engines. As oil engines they operate on the Hesselman principle, with fuel injection and spark ignition. The change to a gasoline engine is made by closing the injector openings by means of plugs and fitting a carburetor in place of the air horn, and the engines can be adapted to burn butane, natural gas, or producer gas by equipping them with a mixer in place of the carburetor. Every engine in the series can be converted by merely changing the equipment which forms the combustible mixture.

After nearly ten years' experience with the Hesselman type of engine it was discovered that by a rearrangement of the manifolding and relocation of the injection and spark-plug equipment, this engine could be made to operate efficiently as a gasoline engine, when equipped with a carburetor. Conversions of industrial engines from operation on Diesel fuel to operation on natural gas had been common practice in the oil fields for years past, and when a survey of the truck and bus fields showed that operators often were unable, or hesitated, to adopt the Diesel engine because of its size, weight, and cost, the Waukesha Motor Company decided to take advantage of the production economies made possible by concentrating on a type of engine which with slight alterations can be operated as an oil engine, a gasoline engine or a gas engine.

This engine, which is of the valve-in-head type, is intended to replace all of the present models of Waukesha L-head truck and bus engines eventually. As an oil engine the new type weighs only a few pounds more than as a gas or gasoline engine, and as a gasoline engine it is said to be on a par

Multi-Fuel Engine

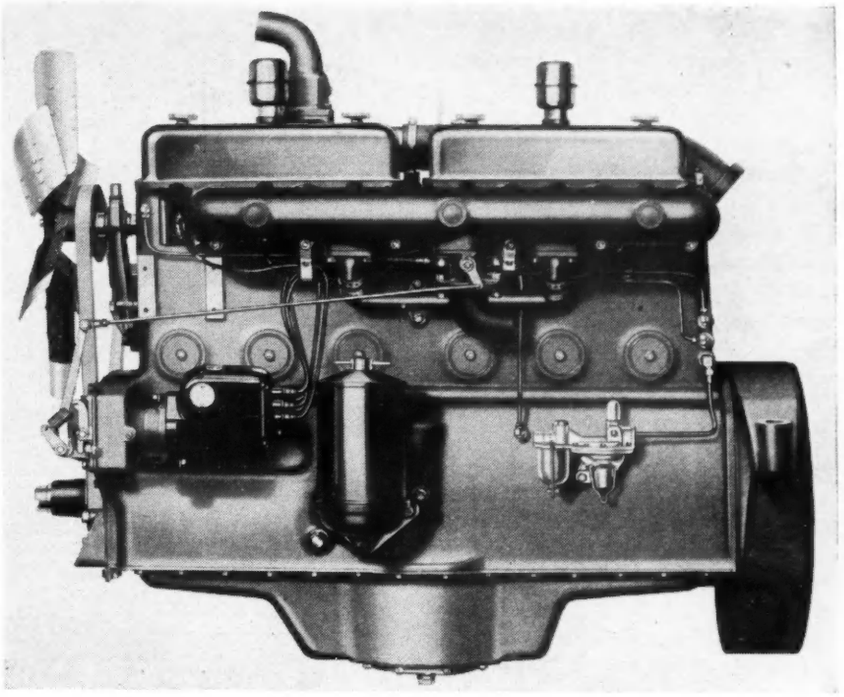
with current models with respect to weight.

Among other advantages claimed for these engines are reduced maintenance and service costs, due to the interchangeability of service parts between gasoline and oil engines, and to the larger production. All of the major parts, including connecting rods, bearings, pistons, rings, pins, valves, camshafts, crankshafts, crankcases and cylinder heads, are the same, whether the engine is equipped as an oil engine or as a gasoline engine.

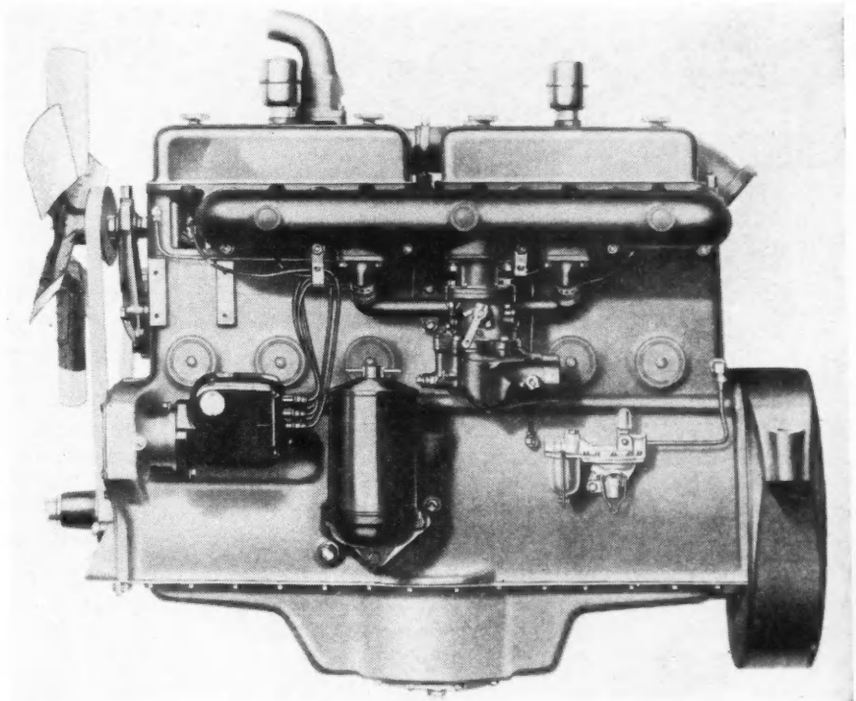
Illustrated herewith is the first of a series of six-cylinder truck engines, of 525 cu. in. displacement. It has a bore and stroke of 4½ by 5½ in., and is rated 125 hp. at 2100 r.p.m. As indicative of the sturdiness of the design, it may be mentioned that the crankshaft has 3-in. main bearings. When built as a gasoline engine, the elbow air horn on the intake side is replaced with a carburetor, the injection equipment on the opposite side is omitted, and in place of the fuel nozzles, screw plugs of the same shape are inserted, so that the compression ratio remains the same, 5.8:1. When the engine operates as an oil engine its consumption is said to run as low as 0.5 lb. per hp-hr., and even better fuel economy has been obtained with gasoline.

The crankcase and cylinder frame are in a single casting, which is provided with heavy "diaphragms" at top and bottom, as well as with baffles to control the flow of the cooling water. Wet-type cylinder liners are inserted in the block, and are cast of Waukesha Moly-chrome iron. Cylinder heads are twin castings, with water-cooled exhaust ports cast integral. The two head castings of each engine are interchangeable. Injector nozzles and spark plugs are carried in the cylinder heads.

Pistons are of cast iron, but aluminum pistons will be furnished as extras on demand. The iron pistons are well ribbed and carry four rings each, all above the pis-



140 Series Waukesha Multi-Fuel Poly-Cycle Engine arranged for fuel oil. Notice air horn and throttle box for engine speed control



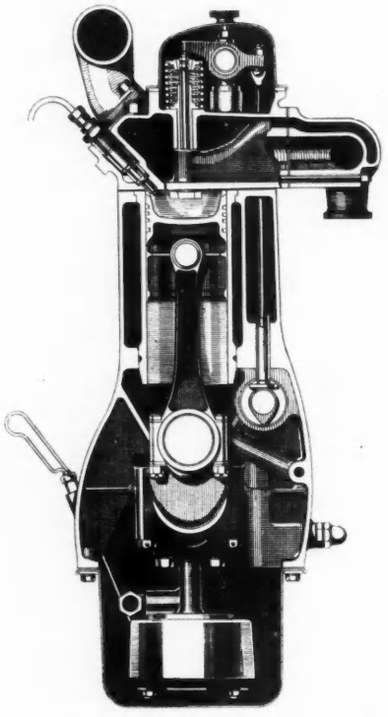
140 Series Waukesha Multi-Fuel Poly-Cycle Engine arranged for gasoline showing carburetor substituted for elbow air horn

ton bosses. Compression rings are 3/16 in. wide, while the single oil-control ring is of ¼-in. width. Piston pins are of the floating type. The crankshaft is made of "Proferal." All main bearings are of 3-in. diameter. The front bearing is 1⅞ in. long; the center bearing, 3 3/16 in.; the rear bearing, 3 in., and each of the intermediate bearings, 1⅞ in. Connecting-rod bearings are 2¾ in. in diameter by 2 in. long.

Connecting rods are drop-forged of 1045 steel and are rifle-drilled for pressure lubrication to the piston-pin bearings. Their large ends are ground to receive the precision-type, steel-back, replaceable bushings. Finished rods are matched in sets whose weights are held within ¼ oz. The piston pins float in bushings of hard bronze.

The intake valves, which are made of chrome-nickel steel, have a clear diameter of 1¾ in., while the exhaust valves, of silicon-chromium steel, have a clear diameter of 1½ in. Exhaust-valve seats are provided with hard inserts of heat-resistant material. Mushroom-type valve tappets are employed, and the entire valve mechanism is enclosed and flood-oiled. Helical timing gears of mild steel are used, with a face width of 1½ in.

Cooling water is circulated by a heavy-duty water pump; its flow is controlled by internal baffles and it is brought close to the valve seats. Oil is forced through large, drilled passages by a gear-type pump, to all main, camshaft, connecting-rod, piston-pin, rocker-arm, and oil-pump drive-shaft bearings, as well as to the stud of the idler gear and to the gears. The valve mechanism and cylinder walls are lubricated by oil mist. The inlet to the oil pump is surrounded by a strainer and oil-level equalizer, for which it is claimed that it prevents air-locking of the oil lines and ensures adequate lubrication regardless of the oil level and the oil temperature. Adjustment of the pressure-relief valve can be made while the engine is in operation. The oil-filter opening is provided with a hair-filled breather cap. A bayonet-type oil-level gage is fitted. An oil pan with the sump at the rear is standard. The oil filter, which is of the waste-packed type, is of relatively large capacity and is mounted on the crankcase; it is shunt-connected.



Typical end section of Waukesha Multi-Fuel Poly-Cycle Engine arranged for fuel oil under Hesselman patents. No change of internal parts is made when engine is converted to gasoline fuel. Combustion chamber, it will be observed, is in piston head

The fuel system furnished with the engine comprises a six-plunger injection pump, Hesselman nozzles, high-pressure lines of drawn steel, and a positively-driven transfer pump which supplies the injection pump from the storage tank. The equipment also includes a gasoline primer and a small gasoline tank, gasoline being used for starting. The waste-type fuel filter furnished has provision for replaceable or repackable elements. When the engine is to be provided with an electric starter, it is equipped with a Mallory oil-engine battery ignition system; otherwise a Bosch magneto is furnished. A built-in centrifugal governor is standard equipment. It is of Waukesha's own design and is fully enclosed and self-lubricating. Special manual speed-control equipment is supplied as an extra.

S.A.E. No. 3 flywheel housing is standard on this engine, while No. 2 can be furnished as an extra. The weight of the Model 140 HK engine (equipped for oil operation) is 1340 lb.

Other models will be added as soon as arrangements for their production can be completed, and the line eventually is to consist of two four-cylinder models of 3¾ by 5-in. and 4 by 5-in. cylinder dimensions and six sixes of the following cylinder dimensions: 3¾ by 5-in., 4⅛ by 5-in., 4¼ by 5½-in., 4½ by 5½-in., 4¾ by 6-in. and 5¼ by 6-in.

German Use of Liquefied Gas Grows

In Germany the use of butane-propane mixtures, or liquefied gases, as a fuel for motor trucks, has increased rapidly during the past several years. This fuel, known as fuel gas, is a by-product of the hydrogenation process for the production of gasoline from coal. At present approximately 15 per cent of the yield of this process is in the form of fuel gas. The number of trucks operated on fuel gas increased from 4000 in 1936 to 12,000 in 1937, to 22,000 in 1938.

One of the reasons for the rapid development of the market for fuel gas is that since 1935 the German Government has been granting tax relief up to 75 per cent, according to the weight class of the vehicle, to truck owners. Municipal authorities received instructions to adapt their vehicles as far as possible to the use of native fuel, especially fuel gas. In accordance with regulations recently issued by the Supervisory Office for Mineral Oils, from Oct. 1, 1939, on (in Austria from April 1, 1940), all motor buses equipped with carburetor engines that have a carrying capacity for 16 passengers or more must be operated on gaseous fuel.

Distributing stations for fuel gas (which is supplied

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"Racing" for World Markets

(*Continued from page 52*)

automotive superiority. No such emphasis has been intended, and none but the most general facts have been presented in support of the opinions advanced. Actually, it is difficult to minimize the present advantage which Germany has built up in racing design.

Their current edge on the world in this respect is so broad that it is only wisdom to face the fact, even while mentally resolving to see whether something can be done about it. Here it may be asked why the Boyle interests did not purchase a German car instead of the Maserati. The answer is simple. The German machines built to the present International Formula are not for sale. Nor are the Italian Alfa-Romeos.

At this writing, the only formula car which has been available on the market is Maserati's, and it is doubtful whether that firm would release another car now, having realized its expressed intention to win the 1939 Indianapolis race with the machine sold to the Boyle organization.

No racing cars of modern European Grand Prix type have yet been produced in the United States, and the Boyle interests purchased a Maserati only after it became evident the cost of building a conventional American design of high quality would be greater than the expense of importing the Italian machine. In other words, no highly developed racing automobiles capable of competing with European machines under the current International Formula are now available in our own country at any price.

Whether anything can and should be done to remedy this situation in the face of an almost inevitable German-Italian invasion in 1940 is at present a matter of conjecture. Only one thing is certain—the American racing fraternity is in no condition to supply an answer unaided. Of recent years, racing in this country has been carried on almost entirely by individuals, lacking adequate financial and technical backgrounds in many cases. Its entire resources and personnel, if they could be coordinated, could not measure up to the task of producing an American design forceful enough to challenge German-Italian dominance under the Formula.

The obvious solution requires a much stronger basis. British racing enthusiasts have begun an approach to the problem during the past year by agitating for a fund of half a million pounds, to be raised by voluntary contributions from the industry and various individuals. This sum is to be turned over to an organization formed to design and build the cars, and all the research data and equipment of the entire British automotive industry is supposed to be available to the group. To date, this plan has made little actual headway. The French have enlisted some small government support for potential Grand Prix construction. This backing, in the form of a very modest subsidy prize granted the winner of an official competition held last year, is at present enjoyed by Talbot. This firm has produced two Grand Prix designs for 1939, neither of which has so far proved very competitive. Individuals of prominence in British and French racing circles are privately somewhat dubious concerning the success of either method.

Proposals of this nature are scarcely appropriate for the American situation. Government subsidies need not be considered because of their controversial nature. Popular subscription of funds is impractical and uncertain. But our automotive industry is the most powerful in the world. It has resources to complete an American formula car of worthy caliber; it employs engineering talent capable of designing such a car, and the men and machines needed to build it.

More difficult to visualize is the matter of incentive. For some years now the industry has been in a position to be independent of automobile racing, feeling little more could be gained by active participation, that, indeed, much might be lost. Times have changed again, and European automotive firms now engaged in Grand Prix racing are once more extending research and design data through racing experience. Eventually this influence is bound to have an effect on world markets, and the American industry may be drawn back into racing for its practical advantage.

Meanwhile, the near future might bring more decisive action. In the event of an official European invasion at Indianapolis next year, our automotive industry is certain to face the possibility of conclusive foreign successes, clearly presaged by the friendly triumph of Shaw's Maserati this year. The industry may adopt the position that its world prestige will be unaffected by further foreign conquests at the stronghold of American speed.

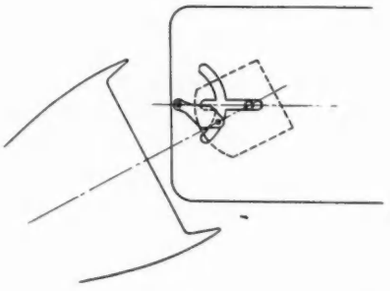
Note. The present International Formula, on paper, was intended to place supercharged and unsupercharged engines of various sizes on equal terms through prorating of car weights. Practical results, however, at once showed the superiority of 3 liter supercharged designs over all others. The term "formula car", in this article, is thus used to denote the 3 liter supercharged design.

Germany Favoring Electric Vehicles

IN 1938 there were in service in Germany the following electric vehicles: Seven thousand buses and trucks, 2000 municipal vehicles, 13,000 industrial trucks and 23 trolley buses. The length of the trolley-bus lines was only 30 miles. Efforts are being made to raise the number of electric vehicles in the country to 50,000 in order to save gasoline, two-thirds of the consumption of which must be imported.

Austin Coupling for Semi-Trailers

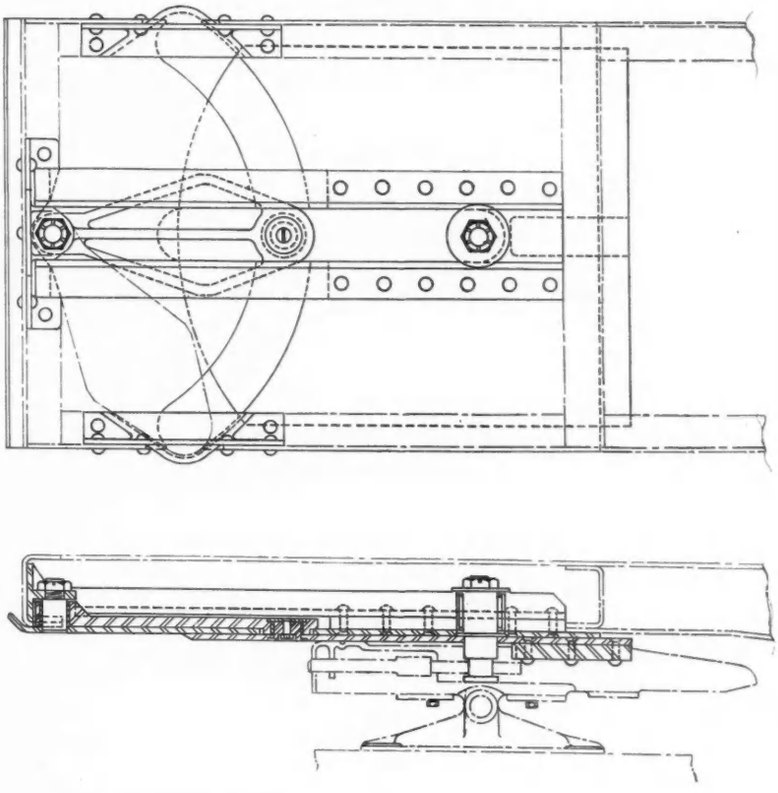
AN INGENIOUS coupling for semi-trailers, which permits of bringing the front of the trailer close up to the rear of the cab of the tractor, is being offered by the Austin Trailer Equipment Co., Muskegon, Mich. Only 6 to 10 in. of clearance is required between the front of the trailer body and the rear of the cab, depending on the width and corner radii of the body. Aside from the improvement in the appearance of the tractor-trailer combination, this has the advantages that for a given total length the loading space is increased, and that more of the trailer load is carried on the rear wheels of the tractor, so that traction conditions are improved.



At the right are plan and transverse views of the Austin coupling while above is a diagram of its application.

A plan view and a section of the mechanism are shown herewith. Use is made of the conventional rocking type lower fifth wheel on the tractor. The king pin, which is secured to the lower fifth wheel is provided with a roller bearing and can slide between guides formed on the upper fifth wheel. A drawbar secured to the lower fifth wheel, so that it must turn with the tractor, connects the king pin to a drawbar pin, which latter is adapted to slide in an arc-shaped slot formed in the upper fifth wheel. A bracket connects the drawbar pin to a pivot pin at the extreme forward end of the trailer.

If the tractor is swung around so that its axis is no longer in line with that of the trailer, the drawbar pin moves away from its central position in the arc-shaped slot, to one side or the other, depending on the direction in which the tractor is being steered, and since the distance between the king pin and the drawbar pin is fixed by the drawbar between them, the king pin then moves forward in the slot in the upper fifth wheel. Thus, in steering, the tractor does not swing around an axis which is fixed with relation to the trailer, as it does with the conventional fifth-wheel construction, but around an axis which moves forward relative to the trailer as the angle between the tractor and trailer axes increases. For an angle of 45 degrees the king pin has moved forward 8¼ in., and for an angle of 90 degrees (which is the limit), it has moved forward 24 in.



Association of Auto-Wreckers

IN a recent issue of AUTOMOTIVE INDUSTRIES we announced the formation of an Association of Auto-Wreckers (or Auto-Demolishers) in France. Contrary to most other trade associations, this one wants the conduct of its industry regulated by the government. At a recent conference of a spokesman for the Association with the Minister of Commerce, the adoption of regulations was urged which would require every firm engaged in auto-wrecking to keep a register in which all of its activities must be recorded. The reason for this was said to be that quite a number of individuals in France make a practice of buying up old cars at prices above their actual junking value, with the sole object of getting hold of the registration cards. These cards are then made use of in connection with stolen cars of the same make which are altered in such a way that it is difficult to trace their origin. In pleading his cause, the representative said people had no idea of the numbers of stolen cars that were put back in circulation in this way.

To prevent such malpractices in future it was proposed that it be required that the license certificate for a car be destroyed at the same time the car is delivered to the wrecker, or is junked. Any such requirement would, of course, necessitate supervision.

Deco Fuel-Injection Pump

Multi-Unit PNA Type

A NEW multiple-unit fuel-injection pump, the Type PNA, has been announced by Diesel Equipment Corporation, Chicago, Ill. It is of the type in which the stroke of the plunger is constant, the delivery per cycle being varied by a spill valve which is opened more or less by the centrifugal governor and is subject also to hand control. Combined with the pump proper is the governor, which not only limits the speed at which the engine can operate, but also automatically varies the timing of the beginning of injection in accordance with engine speed. A variable-capacity, constant-pressure fuel-transfer pump also forms part of the equipment. The Type PNA injection pump is suitable for Diesel engines with up to 120 cu. in. displacement per cylinder.

The cast iron housing of the pump encloses the camshaft which is supported on ball bearings. The pump plungers are actuated from the camshaft through the intermediary of rocker levers provided with needle bearings whose outer races bear on the cams. By giving the rocker shaft an eccentric mounting, the timing of injection begin can be varied through the action of the governor. There is also a fuel-control shaft within the pump housing. This is a sliding shaft having a gear rack for each pump unit, the rack meshing with a pinion on the by-pass valve. The pump housing also provides a drilled distribution header with interconnecting passages forming a fuel reservoir and a suction line for each unit.

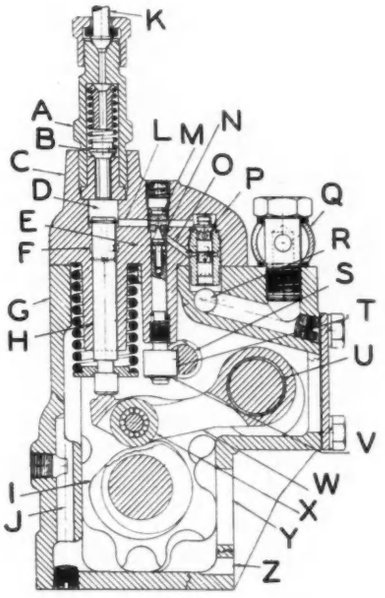


Fig. 1—Cross section through one of the pump units

A, discharge nipple; B, discharge valve; C, pump body; D, pump chamber; E, return passage from spill chamber; F, spill chamber; G, pump housing; H, plunger; I, camshaft; J, overflow drain; K, fuel injection tube; L, fuel inlet passage; M, by-pass-valve seat; N, by-pass-valve; O, by-pass return passage; P, suction valve; Q, fuel-inlet connection; R, fuel-inlet chamber; S, control rack; T, by-pass-valve pinion; U, rocker shaft; V, by-pass-pinion locating washer; W, rocker tappet; X, rocker-tappet roller; Y, transfer-pump pad; Z, oil-drain hole.

The top of the housing is finished to receive the individual pumping units, which are secured in position by four cap screws each, and doweled for location by the by-pass-valve boss. These units are so designed that they can be installed in the housing only if the by-pass-valve pinion is correctly in mesh with the control rack. A small locating washer directly below the by-pass-valve piston registers with a flat surface on the control rack when the latter is held in the indexed position. While a pump unit is being changed, a snap pin holds the control rack in the indexed position. Each pump unit consists of a suction-valve assembly, a by-pass assembly, a plunger assembly, and a delivery-valve assembly.

The suction valve, which is of the

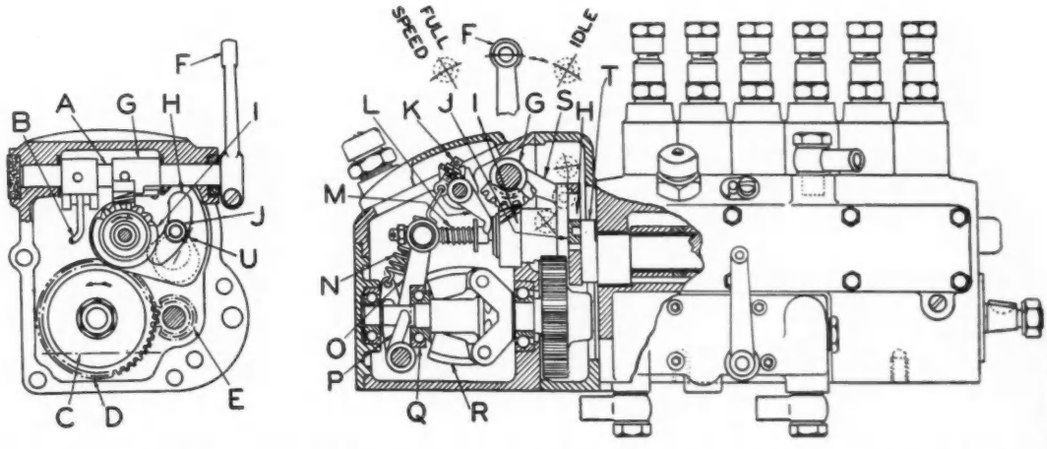


Fig. 2—Two sectioned views of the governor mechanism

A, speed-change-lever shaft; B, governor spring; C, oil level; D, governor-drive gear; E, governor gear; F, speed and timing-change lever; G, timing-change gear (driver); H, timing-change camplate; I, timing-change gear (driven); J, cam roller; K, idling-spring adjusting screw; L, shut-off lever; M, governor-rod to fuel-control rack; N, idling spring; O, governor lever; P, governor-shafting lever; Q, governor-thrust bearing; R, governor weight; S, governor-spring lever; T, eccentric rocker shaft; U, advance position of rocker shaft.

poppet type, is closed by a small spring. Both the delivery valve and its guide are hardened, ground, and lapped, the assembly being retained in the pump body by the hardened discharge nipple, which also encloses the discharge-valve spring and stop.

The plunger is drilled axially from the top end to a point where radial holes provide a passage to the spill chamber when the plunger approaches the end of the effective stroke. Thus the delivery is cut off before the plunger reaches the end of the up-stroke. The spill chamber consists of a circumferential counter bore in the barrel connecting with the suction chamber through a drilled passage.

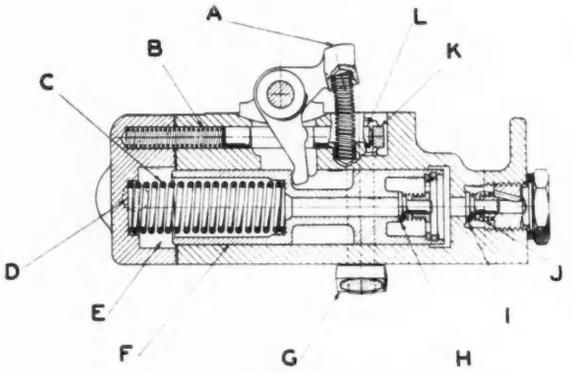


Fig. 3—Section through transfer pump

A, transfer-pump lever; B, priming-push-rod spring; C, plunger spring; D, fuel inlet; E, suction chamber; F, plunger; G, priming lever; H, suction valve; I, discharge valve; J, discharge outlet; K, priming rocker; L, priming pushrod.

The amount of fuel injected per cycle is governed by the setting of the by-pass valve, which is controlled by the control shaft through the rack and pinion. From the sectional view, Fig. 1, it will be seen that the by-pass-valve is a needle valve which is opened more or less by turning it around its axis. This valve can be opened sufficiently so that all of the fuel moved by the plunger will be by-passed and none enter the engine. The sliding control rack is operated by the governor. In normal operation, up to rated engine load, the by-pass-valve is never fully closed. It is closed only when the engine carries the maximum permissible overload. There is a large inspection door on the pump housing through which the working parts can be inspected.

The automatic speed and injection-timing governor, Fig. 2, is of the centrifugal type; it is enclosed in an aluminum housing which is bolted to the end of the pump housing. The governor is driven from the camshaft at about three times the speed of the latter. In the governor, liberal use was made of anti-friction bearings, and the device is claimed to be exceptionally sensitive. Centrifugal force on the governor weights is balanced by two sets of springs. An independent idling spring holds the engine at the proper idling speed and in automotive installations completely shuts off the injection when coasting above idling speeds. The setting of the idling spring can be adjusted independently.

A second set of springs controls the engine from idling to full-rated speed. The tension of these springs is changed in accordance with the vehicle speed desired by the driver, by means of the speed- and timing-change lever, which has a range of motion of about 60 deg. Advancing and retarding of the beginning of injection is accomplished by rotating the eccentric rocker shaft by means of the cam roller. Fixed on the speed-change-lever shaft are the hand lever, spring lever, and timing change gear (driver). Meshing with the latter is the driven gear of the timing-control mechanism, which carries with it a fixed and a removable camplate. A pin and roller, fixed to the rocker-shaft hub, follow the contour of the movable camplate and thereby impart to the rocker shaft the proper timing movement. The shut-off lever, pressing against a collar on the control rack, and thereby against the spring, provides means for by-passing all of the fuel moved by the plunger, thereby bringing the engine to a stop. All parts of the governor and timing mechanism are lubricated by the supply of oil in the governor housing. Where the automatic timing is not desired, the timing-control shaft may be brought out at the opposite end and facilities provided for a fixed setting.

Another part of the injection equipment is the transfer pump, of which a section is shown in Fig. 3. It is of the plunger type, the plunger being moved by an eccentric on the camshaft of the pump during the suction stroke, and by a coil spring inside the plunger during the delivery stroke. This pump operates on the variable-stroke, constant-pressure principle. The body of the transfer pump is of cast iron, while the plunger is made of steel, hardened, ground, and lapped. By means of a priming lever the system can be primed by hand. After hand pumping is discontinued, the lever automatically assumes its neutral position and it does not move during normal operation of the transfer pump.

German Use of Liquefied Gas

(*Continued from page* 74)

in light steel bottles) have been established all over Germany by three large companies. Originally it was planned to effect distribution through gasoline filling stations, but this plan was later abandoned. The bottles are loaned by the fuel companies and operation on fuel gas is said to run 25 per cent lower in cost than operation on liquid fuels.

Among the advantages claimed for this fuel gas is that it has the same anti-knock value as 100-octane gasoline, that it improves the distribution, thereby increasing the efficiency of the engine, and that it prevents crankcase dilution and carbon deposits in the combustion chamber. The rapid increase in the number of commercial vehicles equipped with apparatus enabling them to burn fuel gas is reflected by registration figures. During the year which ended on June 30, 1938, the number of such vehicles operating on fuel gas increased 54 per cent, while Diesel-engined vehicles increased 35 per cent and carburetor-engined vehicles 10 per cent. It is also interesting that the number of vehicles equipped with hot-bulb engines increased 38 per cent.

MEN and MACHINES....

(Continued from page 71)

It is claimed that, generally, a grade softer wheel can be specified with no loss in production and at no increase in wheel cost. Tests are also said to show that while maintaining the same production there is less wear of the spindle bearings and fewer adjustments are required.

A slide rule designed to solve an unusual range of industrial problems has been developed by the Eugene Dietzgen Co., Chicago. The Langsner rule, as it is called, has six scales: two of them above the slide represent feed, length of cut, and diameter; three on the slide represent r.p.m., time, and cutting speed; the regular D scale is below the slide. The reverse side of the slide contains the usual B, CI and C scales, for standard slide rule calculations.

A new development in which degreasing can be applied to cup-shaped work is effected through the rotating basket design of the Detrex degreaser illustrated on page 70. The machine, a product of Detroit Rex Products Co., consists essentially of a one-dip or liquid-vapor design with storage tank and a special automatic elevator mechanism which raises and lowers the rotating baskets. A continuous filter shown at the side of the machine is used to keep the boiling chamber free of insoluble material, and a continuous operating Detrex solvent still is used to remove oil contamination. By this means the work is always immersed into clean solvent, and a final pure-vapor cleaning action is given as the work is raised out of the boiling solution. A clean solvent storage tank is located at the rear side of the degreaser. The machine is manufactured in various sizes ranging in capacity up to two tons per hour.—H.E.B.J.

Publications Available on Machine Tools

An application chart for **laminated shims** has been prepared by the Laminated Shim Co., Inc., New York, N. Y.*

Knu-Vise **knuckle action holding fixtures** and Knu-Sine **universal toggle clamps, layout tables, etc.,** are described in a folder published by the Knu-Vise Products Co., Inc., Detroit.*

"Ideal" **cleaning machinery for metal parts** is described in catalog No. 40 issued by N. Ransohoff, Inc., Cincinnati, Ohio.*

Bulletin L-212 issued by All Steel Welded Truck Corp., Rockford, Ill., describes the company's latest development—the **Clark Steel Weld Truck.***

Type APE **fuel injection pump** manufactured by the American Bosch Corp., Springfield, Mass., is described in an illustrated folder just brought out by the corporation.*

Subject of a bulletin issued by Physicists Research Co., Ann Arbor, Mich., is the **profilometer,** an instrument for measuring surface roughness.*

Carboloy Co., Inc., Detroit, has issued an engineering bulletin (GT-114) giving detailed recommendations for proper **Carboloy** grade selection, suggested speeds and feeds, and a method for determining power requirements. A companion bulletin (GT-115) listing the physical characteristics and general use of all Carboloy grades is also available.*

"Understanding the Automotive Diesel" is the title of a booklet prepared by the Mack-International Motor Truck Corp., Long Island City, N. Y.

A book entitled **"Simple Blueprint Reading with Particular Reference to Welding and Welding Symbols"** has been announced by the Lincoln Electric Co., Cleveland, Ohio. It is available from the company at $0.50 the copy, postpaid anywhere in the United States, $0.75 elsewhere.

A **lamp calculator** designed to simplify the evaluation of various grades of lamps on the market has been developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The Lamp Division is offering a limited supply of these calculators at 15 cents each.

Illustrations and listings of all types of **drills, reamers, screw extractors, counterbores, interchangeable punches, etc.,** manufactured by Whitman & Barnes Division of United Drill and Tool Corp. will be found in catalog No. 96 just issued.*

Link-Belt Co., Chicago, has completed its new 1278-page general catalog No. 800.

Bakelite Corp., New York, N. Y., has brought out a booklet entitled "New Paths to Profits" which is defined by the company as a businessman's guide to modern **plastic materials.***

The American Metal Hose Branch of the American Brass Co., Waterbury, Conn., has published a catalog covering **seamless flexible metal tubing.***

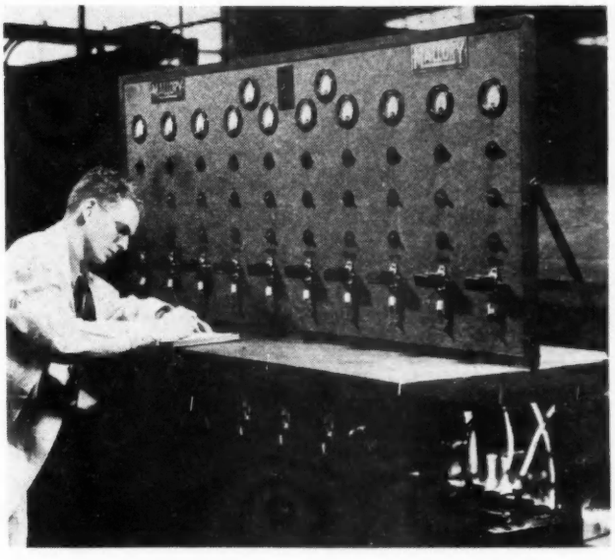
A comprehensive catalog of **flexible couplings** has been prepared by the Morse Chain Co.*

Davis tubular micrometers are described in a circular issued by Davis & Thompson Co., Milwaukee. Wis.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Generator Cut-Out and Horn Relay Test Bank

This 10-position test bank for generator cut-outs and horn relays is one of several unusual testing devices in use at P. R. Mallory & Co., Inc., Indianapolis. The device was designed primarily to determine the operating characteristics of the units as well as the suitability of various contact alloys. It is possible to apply circuit conditions varying in resistance, inductance, and capacity over a wide range to each of the 10 units accommodated by the bank.



Another interesting piece of test equipment at the Mallory plant is a device which makes it possible to measure operating characteristics of a single automobile distributor without removing the unit from a gang test bank. Outstanding feature of the equipment is that it facilitates close observation of operating characteristics of the unit and, through the use of an adaptor, study of all the various types of ignition systems manufacured in this country and abroad.

New Steels to Meet New Requirements

(*Continued from page* 58)

unfavorable experience would result with leaded steel and which may account for some of the varied reports of its value.

Lead has one advantage in that it does not seem to impart any unfavorable properties to steel. The leaded steel can be readily rolled and forged, it carburizes and hardens satisfactorily. Impact does not seem to be materially affected.

Other means are being investigated toward improving machinability. In the molybdenum alloy steels molybdenum sulphide instead of calcium molybdate or ferro molybdenum as an addition is claimed to produce better machining steels. Another is an addition of sodium fluoride and litharge.

To improve physical properties by the elimination of oxides, of nitrogen and other gases and to promote the coalescence of inclusions several new deoxidizers are being employed. One of these sponsored by the Electro-Metallurgical Corp. is Silvaz. The composition is said to be: silicon, 45 per cent; aluminum, 7 per cent; vanadium, 7 per cent; zirconium, 7 per cent; iron remainder.

Another is Grainal composed of silicon, aluminum and titanium. Others are zirconium silicon and various alloys composed of calcium and manganese with silicon. The composition of these various deoxidizers is not of general interest except as they indicate the tremendous amount of work that is being done to improve the quality of steels.

The carbon molybdenum or Amola steels have been in use for about five years hence cannot be regarded as new but during this period most of the production has been confined to one large automobile organization and the parts makers supplying it and not until recently has its adoption become more general to unrelated industries. Steel of this type may now be purchased from any of the leading American or Canadian steel plants all of whom are licensed to produce it.

In this steel advantage has been taken of that unfortunate term known as abnormality which was conferred on fine grained steels a number of years ago. No doubt abnormal steels at that period were over-oxidized heats doctored in the ladle with generous additions of aluminum and did characterize poorly made steel. But the entire structure upon which this development is based is upon a fine grained abnormal microstructure having more or less indefinite grain boundaries. To be classed as Amola steel four standard microstructures have been set up known as A, B, C and D. The A pattern represents the nearly normal grain size and D the finest grain with the least evidence of grain contour. B and C, of course, represent the intermediates between these extremes. Good Amola steel should be the B, C or D rating.

By great care in setting up the steel practice and the judicious employment of molybdenum it has been possible to produce an abnormal steel capable of imparting the desired fibrous characteristics, excellent strength and at the same time regulate the chemistry so the steel would not be difficult to harden.

These steels cover a range of 0.20 per cent to 0.70 per cent carbon and all show 0.15 percent to 0.25 per cent molybdenum which is the only alloy used. However, due to the employment of molybdenum and the exacting set-up for its manufacture, it is classed as an alloy steel.

The carburizing grades are usually between 0.25 per cent and 0.35 per cent carbon which is a departure from the usual 0.10 per cent to 0.25 per cent which represents the average carbon limits for the carburizing grades. Also the oil hardening types are generally 5 to 10 points higher in carbon than an equivalent type of other alloy steels. The object of this is to improve the hardenability. These steels show very little distortion in heat treatment.

At the present time these steels have not been recognized by the Society of Automotive Engineers and possibly will not be until they are in more general use. They were first employed for coil spring in front axle construction, then leaf springs, rear axles, later for ring gears and pinions and finally for transmission gears and shafts. Recently they have been applied for bolts and screws replacing the alloy type. Each new application has been cautiously handled.

In many of the automobile plants the trend has been toward cheaper steels. Several have almost entirely eliminated the use of alloy steels and have substituted what might be termed the deluxe high manganese carbon steels made with special deoxidizers. These steels vary from 1.30 per cent to 1.90 per cent manganese corresponding to the S.A.E. 1300 series. These new manganese are quite an improvement over the older type although the actual chemistry of the steel has not been greatly modified. Even transmission and rear axle gears are being fabricated from these steels. Their success requires accurate control of grain size, hardenability and physical properties.

There is a growing increase in the employment of medium carbon nickel molybdenum steel for cyanided gears. This is S.A.E. 4640 which was first recognized by the Iron & Steel Committee of the S.A.E. in 1935. This steel was first adopted by Warner Gear Co., but its high strength, excellent impact and fatigue resisting properties and, more important, its minimum distortion in heat treatment has resulted in more gear makers adopting it. It is one of the best of the so-called oil-hardening gear steels.

The metallurgical picture is moving with great strides and it is difficult to keep up with the dynamic changes taking place in all the industries. There is still a lot to be learned of the unexplainable idiosyncrasies of metals, the function of gases in contact with hot metal surfaces, the effect of dissolved gases in steel and other metals and numerous baffling problems which a future generation will solve.

NEWS OF THE INDUSTRY

Revisions in Wagner Act Urged by A.M.A.

Senate Committee Given Report of "Agitation, Unrest And Turmoil" in Industry Since Enactment of N.L.R.A.

More testimony that the Wagner Act inaugurated a period of agitation, unrest and turmoil in industry instead of reducing labor disputes as was intended by its sponsors was given to the Senate Education and Labor Committee on June 27 by spokesmen for the automobile industry.

William J. Cronin, secretary of the Manufacturers Committee of the Automobile Manufacturers Association, who submitted for the record a 74-page booklet, replete with photographs showing strike damage, weapons used by strikers and evidence of sabotage, related to the committee how former convicts had participated in unionization drives in the industry, how union representatives coerced workers to join up with them, and how they had intimidated civil authorities.

The witness described the sit-down strikes in Michigan and referred to the current factional split in the automobile unions, maintainng that the employes do not have a remedy for this situation under the Wagner Act. He proposed that the law be revised to include provisions insuring workers real freedom of choice in selecting or rejecting bargaining representatives without coercion or intimidation by any one; insuring compliance with agreements by all parties thereto, subject to equal penalties for violation; and insuring that strikes and other stoppages of production shall represent the will of at least a majority of the employes and not the ill-considered action of a few.

Going into detail on troubles encountered from time to time by individual members of the association, Mr. Cronin said that the present intra-union split in the industry, involving millions of dollars, power and prestige, threatens to be a bitter one.

"Plant managements," he said, "have made every effort to maintain a position of strict neutrality. They do not know whom to recognize either as representatives of the national organization or of its plant locals. In the case of divided local unions managements have decided to deal with representatives of either faction, except in the presence of representatives of the other.

"Where that opportunity has been rejected, or has proved impractical in operation because of the hostility of the factions toward each other, adjustment of grievances and negotiations have

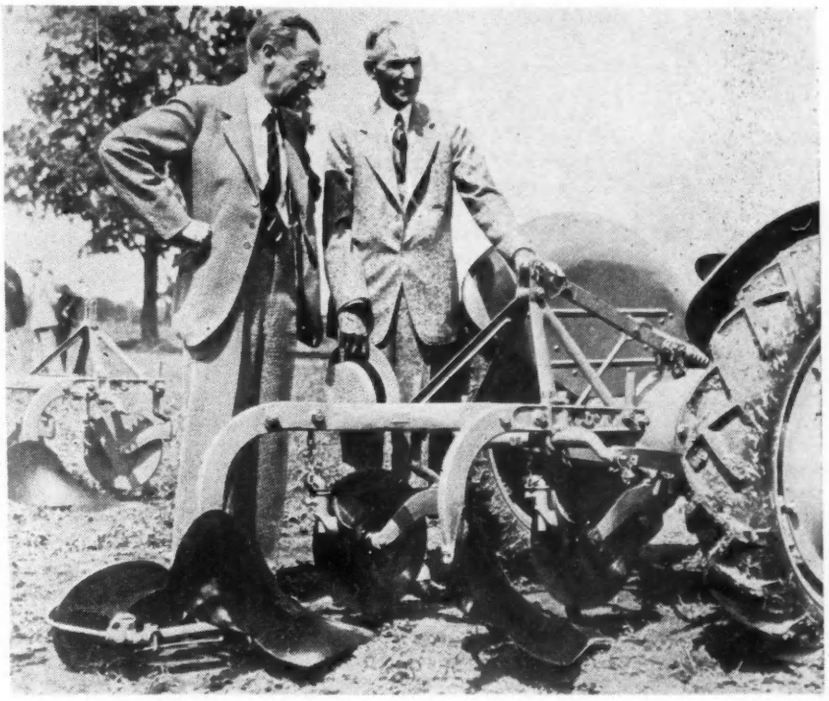
(*Turn to page 87, please*)

Nash Spending $700,000 On Plant Modernization

Approximately $700,000 will be spent by the Nash Motors division of Nash-Kelvinator Corp. for retooling, new machinery and improvements at the Milwaukee and Kenosha plants this summer, R. A. DeVlieg, general works manager of the division at Kenosha, has announced. The machinery will be installed and improvements made during the regular summer shutdown. Nash-Kelvinator has spent about $4,000,000 in the last two years in modernizing its motor plants.

Dr.-Eng. Tranquillo Zerbi

Word comes from Italy of the death of Dr.-Eng. Tranquillo Zerbi, director of engineering of the Fiat company. Dr. Zerbi was a specialist in combustion-engine design and is given credit for the development of superchargers for the engines of racing cars and of the 3100 hp. aircraft engine that powered the seaplane with which Agello established a world's record of 441 m.p.h.



Acme

Proud Progenitors

Henry Ford (right) and Harry Ferguson inspect the new type lightweight tractor which they jointly developed and recently announced. Now being produced by the Ford Motor Co., the tractor is described in detail on page 66 of this issue.

Acme

"Grease Monkeys" for Emergency

French women, decorated with the Legion of Honor, have founded a center in Paris where Air Raid Precautions training is being given. A special class provides women with automotive training intended to enable them to make repairs on cars and trucks in the event of war.

Farsighted Judges in Early 1900's Found Motor Vehicle "Legitimate"

Dusty Law Records Reveal Amusing Legal Actions In Many Cases of the Automobile Vs. the Horse

When motor cars first began chuffing down the highways, judges and horses alike were skittish. Neither knew quite which way to jump. If the automobile was an infernal machine and inherently dangerous, as most horses insisted, judges would be duty bound to hold owners of the unsocial devices absolutely liable for the results of their operation.

Horses were soon running in all directions. In Indiana an owner brought suit alleging that the automobile which caused the runaway had been not only negligently operated but that even the placing of so dangerous a contraption on the highway was negligence sufficient to fix responsibility upon its possessor. Complained the horse owner, "The automobile was 12 feet long, five feet wide and eight and one-half feet high, it had a canopy top, elevated seats for passengers, was painted red and was propelled by an exploding gasoline engine which made a great noise." In describing the accident he alleged that the car was being driven, "at a great speed, to wit: 20 m.p.h., thereby causing it to give forth a loud, whirring, puffing, buzzing noise that could be heard several hundred yards."

Judicial brows knit. Then came the answer—the "go ahead" signal that automobile manufacturers must have been anxiously awaiting. Said the court* in part, "It cannot be said, as a matter of law, that appellant (automobile owner) was guilty of negligence for using an automobile as a means of conveyance on the public highway. . . . In all human activities the law keeps up with the improvement and progress brought about by discovery and invention, and, in respect to highways, if the introduction of a new contrivance for transportation purposes, conducted with due care, is met with inconvenience and even incidental injury to those using ordinary modes, there can be no recovery, provided the contrivance is compatible with the general use and safety of the road."

In 1905 a pedestrian was killed in Atlanta, Ga. The car was being driven without the owner's permission. Was the owner liable merely because it was his machine? "No!" said the court,** "It is not the ferocity of automobiles that is to be feared but the ferocity of those who drive them. Until human agency intervenes, they are usually harmless. While by reason of the rate of pay allotted to judges in this state few, if any, of them have ever owned one of these machines, yet some of them have occasionally ridden in them, thereby acquiring some knowledge of them; and we have, therefore, found out that there are times when these machines not only lack ferocity, but assume such an indisposition to go that it taxes the limits of human ingenuity to make them move at all. They are not to be classed with bad dogs, vicious bulls, evil disposed mules and the like."

So it went in a score of states until the question was no longer asked. Horses might continue to eye automobiles with suspicion but the judges had made their decision. The automobile was legitimate.

* 165 Indiana Reports 465; 74 N.E. 615.

** 3 Georgia Appeals 50; 59 S.E. 338.

New Registrations in June Estimated at 54% Over '38

The nation's new passenger car registrations in June are expected to exceed those in the same month last year by about 54 per cent, according to R. L. Polk & Co.

Leading the parade are the East North Central states (Illinois, Indiana, Michigan, Ohio and Wisconsin) with an expected increase of 84.65 per cent; East South Central States (Alabama, Kentucky, Mississippi and Tennessee) with a probable gain of 64.34; and the Middle Atlantic states (New Jersey, New York and Pennsylvania) where a gain of 63.33 per cent over last June is indicated by returns for the first 14 days of this month.

Other sections have prospective increases as follows: West North Central states, 23.92 per cent; South Atlantic, 39.43 per cent; West South Central, 33.72 per cent; Mountain, 55.69 per cent; Pacific, 22.68 per cent; and New England, 1.52 per cent.

Campbell Will Aim for More Speed in New Boat

World motor boat speeds, which are topped by the unlimited hydroplane mark of 130.93 m.p.h. set by Sir Malcolm Campbell with his special mile trial boat "Bluebird" in Switzerland last fall, may have a general revision this summer in view of the many record attempts planned in the United States and abroad.

Campbell is planning to make a run next month, probably on Lake Bala, in Merionethshire, England, with a new boat built from American designs. Jean Dupuy, French outboard driver, now lays claim to the world Class X outboard record of 79.03 m.p.h., made over a one-kilometer course on the Seine at Paris. This mark, if approved, will surpass the 78.12 m.p.h. speed made two years abo by Bedford Davie, of Tuxedo Park, N. Y.

Among other international water speed records the Gold Cup, or 12-liter standard of 91.408 m.ph. established by

Count Theo Rossi, of Italy, at Washington, D. C., in 1937, may be subjected to attack. Rossi is still racing the same record holding craft, Alagi, but several new American Gold Cup boats have been built for which speeds of upwards of 100 m.p.h. are claimed.

Employment at American Brass Plant Near Normal

The Buffalo, N. Y., plant of the American Brass Co., manufacturers of brass sheets, tubes and copper, currently is employing about 1000 men, compared with normal employment of 1250, according to Ralph H. Attmore, assistant manager.

"Business has been dropping off a little of late, although there has been no decided change," Mr. Attmore said. A considerable amount of the Buffalo plant's production goes to the automobile industry, and with car makers now in the midst of model changeover orders from this source are running light, Mr. Attmore said.

Business of the company currently is running slightly above a year ago, however, Mr. Attmore added. "Our business changes from week to week and it is difficult to forecast just what the trend of production will be," he said.

Wallace F. MacGregor

Wallace F. MacGregor, 65, one of the world's leading farm implement engineers, and director of the J. I. Case Co., Racine, Wis., died at a Racine hospital June 18 following an illness of three months. He had been associated with Case for 41 years, and in recent years had been a director and chief engineer in the development of threshers and combines. At one time Mr. MacGregor was president of the American Society of Agricultural Engineers, and at the time of his death was a member of the American Society of Mechanical Engineers. He was a member of important committees in both engineering societies.

Car Registration Deadline Set for April 1 in Wisconsin

Governor Julius P. Heil, Wisconsin, has signed a bill permanently advancing the deadline for automobile registration from Feb. 1 to April 1. The measure, introduced by Senator Miller, Mucoda, also fixes the deadline for 1940 registration of trucks, tractors, trailers and semitrailers, as July 15. Previously the deadline for automobile license registration had been Feb. 1, but in recent years the Legislature had extended the deadline as far as March 15. Complaint against the former deadline was primarily that the automobile owner was burdened with year-end bills, especially the Christmas expenditures.

John Bjorn

John Bjorn, 78, former general superintendent of the Nash Motors Co., Kenosha, Wis., died at his home in that city following a short illness. He was a native of Ostmark, Sweden, coming to America in 1890.

Acme

Bomber "Brain"

This is said to be the first photograph ever taken in the control room of the largest British bomber, the Handley-Page Harrow monoplane. The second pilot (standing) is checking navigation at the chart table. Seated at the left is the radio operator. The first pilot is in the cockpit forward. Note that the men wear parachute harness and oxygen-breathing apparatus.

FTC-GM Dealer Case to Be Resumed Aug. 2 in New York

Ourselves and Government—A Check List Of Federal Action Corrected to July 7

FEDERAL TRADE COMMISSION

VS. GENERAL MOTORS. Rebuttal testimony scheduled to be resumed by respondent on Aug. 2 in New York. Closed in Colorado Springs on June 27. Case involves FTC allegation that GM dealers are required to handle GM parts exclusively.

SIX PER CENT CASE. No dates fixed for final arguments although testimony has been concluded in the GM case. Involves the charge that both Ford and GM engaged in allegedly false and misleading representations in finance plan advertising.

F.O.B. PRICE CASE. Still open for testimony. The Commission alleged that both GM and Ford engaged in misleading price advertising.

FAIR TRADE PRACTICE RULES. (No developments).

Passenger Car and Truck Production

(U. S. and Canada)

	May 1939	April 1939	May 1938	FIVE MONTHS 1939	FIVE MONTHS 1938	Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	222,909	257,058	140,239	1,246,085	703,752	+ 77.0
Foreign Market—U. S.	14,961	16,351	14,719	84,910	96,234	− 11.9
Canada	11,585	12,791	13,641	59,383	65,088	− 8.7
Total	249,455	286,200	168,599	1,390,378	865,074	+ 60.8
Trucks—U. S. and Canada						
Domestic Market—U. S.	47,092	50,981	27,935	250,106	162,223	+ 54.0
Foreign Market—U. S.	12,546	12,982	9,166	62,712	66,464	− 5.5
Canada	4,121	4,100	4,474	19,857	22,338	− 10.9
Total	63,759	68,063	41,575	332,675	251,025	+ 32.5
Total—Domestic Market—U. S.	270,001	308,039	168,174	1,496,191	865,975	+ 72.3
Total—Foreign Market—U. S.	27,507	29,333	23,885	147,622	162,698	− 9.2
Total—Canada	15,706	16,891	18,115	79,240	87,426	− 9.3
Total—Cars and Trucks—U. S. and Canada	313,214	354,263	210,174	1,723,053	1,116,099	+ 54.4

Farm Equipment Exports Up To $6,548,384 in May

The Commerce Department's Machinery Division estimated last week that exports of farm implements and machinery during May reached a value of $6,548,384, representing little change from May, 1938, when they were valued at $6,545,386. Foreign shipments of most types continued at lower levels than a year ago, the department said, but the decreases were more than offset by larger consignments of wheel and fuel injection type tracklaying tractors.

Exports of tractors and parts were up 11 per cent to a value of $4,814,843; while tillage implements dropped 8 per cent; harvesting machinery 17 per cent; and seed separators 30 per cent below the May, 1938, figures.

Undistributed Profits Tax Displaced by New Measure

Revenue Act of 1940 Substitutes Flat 18% Income Levy On Corporations Earning More Than $25,000 Per Year

After affixing his signature to the new tax bill, which terminates the controversial undistributed profits tax. President Roosevelt declined comment on the measure, except to say that it presents several administrative problems on which the Treasury Department is working. He turned aside questions as to what effect the new law would have on business, insisting that he had no information one way or the other as to whether it would stimulate business.

The new measure, which becomes the Revenue Act of 1940, strikes out the remaining remnant of the undistributed profits tax and substitutes a flat 18 per cent income levy on corporations earning more than $25,000 a year. It was designed to remove tax "irritants" and help speed business recovery, but it was only in recent months that there were indications that President Roosevelt might change his attitude on the undistributed profits tax and sign the measure.

This change of attitude came, however, after it became evident that members of the Senate Finance Committee threatened to take matters in their own hands to stimulate business through a new tax bill. At this juncture, the President relaxed his former position, announcing that he had no objection to eliminating the undivided profits tax if other ways of making up the tax loss were found and if no new loopholes were opened up for tax avoidance.

While he declined comment on the new revenue law, Mr. Roosevelt talked freely on the possibility of an income tax based on gross earnings in lieu of the present system of taxing net incomes. He expressed himself as opposed to any gross earnings tax and reminded his questioner that it might work hardship on persons in the low income brackets.

The White House has recently announced that the income tax base should be broadened, but that little could be expected in additional revenue because of the difficulties involved in collecting the tax. The gross income tax was put forward at a press conference by one reporter, who said that the tax could be more easily collected, but Mr. Roosevelt did not comment on this phase of the inquiry.

May Casing Shipments Topped April by 9.1%

Shipments of pneumatic casings for highway transportation during May are estimated by the Rubber Manufacturers Association to have been 4,753,403 units. This figure shows an increase of 9.1 per cent above April shipments, and represents a 44.4 per cent increase over shipments made during May, 1938.

Shipments of casings to automobile manufacturers are estimated to have been 1,414,798 units which is lower than the April figure of 1,528,637 but higher than for May, 1938, when 731,605 casings were shipped to automobile manufacturers.

May shipments of casings for replacement purposes were estimated to have been 3,240,936 units which is higher by 18 per cent than April shipments of 2,736,155 and higher by 31 per cent than May, 1938, shipments, which amounted to 2,474,301 units.

MEN . . . . . .

Lester M. Curtiss, who has been assistant general superintendent of Lukens Steel Co., Coatesville, Pa., has been appointed general superintendent in charge of all operations of the company.

David R. Calhoun has been named manager of the industrial division of the Wilkening Mfg. Co., Philadelphia.

Morris E. Leeds, founder and president of the Leeds & Northrup Co., Philadelphia, has assumed the position of chairman of the board of directors, and **Charles S. Redding** has been advanced from vice-president in charge of research and engineering to president.

Lee D. Cosart has been promoted to the position of general sales manager of the Plymouth Div., Chrysler Corp.

B. M. Horter has been appointed general sales manager of Cutler-Hammer, Inc., Milwaukee.

C. J. Edwards has been appointed Detroit district sales representative of LaSalle Steel Co., Chicago, succeeding the late J. R. Ide.

Frank S. O'Neil is now general manager of the Link-Belt Co. plants in Indianapolis.

C. W. "Ted" Grange has joined the Stewart-Warner Corp. as advertising manager of the Alemite division. Mr. Grange was formerly associated with International Research Corp.

Dr. W. A. Wesley, of the International Nickel Co.'s research laboratory at Bayonne, N. J., was recently awarded the annual gold medal of the American Electro-Platers Society in recognition of his paper on "Physical Properties and Uses of Heavy Nickel Deposits."

A. R. Boscow has been named assistant to the general sales manager of Nash Motors Div., Nash-Kelvinator Corp. For the same company, **Richard H. Grant** has been named advertising manager. Mr. Grant was frmerly associated with Geyer, Cornell & Newell, Inc., Nash's advertising agency.

Acme

Scores Seeing

To score a motorist's ability to see out of the corner of his eyes when nearing an intersection is the function of this gadget which was shown at the American Optometric Association Convention held in Los Angeles, Calif., June 25 to 29.

Monthly Motor Vehicle Production (U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1939	1938	1939	1938	1939	1938
January	291,444	168,890	62,502	58,062	353,946	226,952
February	250,897	151,133	61,244	51,464	312,141	202,597
March	312,392	186,341	77,097	52,106	389,489	238,447
April	286,200	190,111	68,063	47,818	354,263	237,929
May	249,455	168,599	63,759	41,575	313,214	210,174
June	.....	147,545	.....	41,857	.....	189,402
July	.....	112,114	.....	38,336	.....	150,450
August	.....	61,687	.....	35,259	.....	96,946
September	.....	69,449	.....	20,174	.....	89,623
October	.....	192,906	.....	22,380	.....	215,286
November	.....	335,767	.....	54,638	.....	390,405
December	.....	341,524	.....	65,492	.....	407,016
Total	.....	2,126,066	.....	529,161	.....	2,655,227

of Industrial Advertisers. Other officers are **P. C. Ritchie,** Waukesha Motors Co., vice-president, and **L. H. Billings,** Falk Corp., secretary-treasurer. Mr. Tate succeeds **Walter E. Schutz,** advertising and sales promotional manager of the Delta company.

Bureau Reports on 1939 Motor Vehicle Legislation

Motor vehicle fuel tax legislation was enacted in 14 states and motor vehicle license legislation was enacted in 25 states in the 1939 sessions of legislatures, according to a summary released by Director William L. Austin of the Bureau of Census.

Motor vehicle fuel legislation dealt mostly with continuation of present acts and present rates or with minor administrative changes. A few states authorized tax exemptions for fuel used in connection with farm machinery. A Tennessee enforcement measure forbade entrance into the state with more than 18 gallons of gasoline in the tank.

The most important new laws concerning motor vehicle licenses dealt with reciprocity and with the taxation of commercial vehicles. Iowa and Maine passed laws granting immunity for a limited time from motor vehicle registration fees to visitors coming from states granting corresponding privileges. A similar exemption in New Mexico was made to apply to cars used in connection with cattle grazing in adjoining states. Reciprocity was carried into the international field by Connecticut and Rhode Island, which exempted foreign cars and operators from local registration fees in accordance with the articles of the International Convention of Paris.

Motor Vehicle Fuel Sales and Use Taxes

1. Continuing present rates or acts: Minnesota, Montana, Ohio, Pennsylvania and West Virginia.
2. Increase in rates: North Dakota.
3. Exemptions: Minnesota, North Dakota, Oregon and South Dakota.
4. Earmarking receipts for specific purposes: Idaho, Maine and Utah.
5. Extension of scope and administration: Minnesota, Nevada, New Mexico, Tennessee and Utah.

Motor Vehicle Taxes

A. Fees levied: Alabama, Arizona, Arkansas, Idaho, Iowa, Maine, Maryland, Minnesota, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Tennessee, Utah, Vermont, Washington, West Virginia and Wyoming.

B. Exemptions:

1. Reciprocity among states: Iowa, Maine and New Mexico.
2. Reciprocity with foreign countries: Connecticut, Rhode Island and Vermont.
3. Other: Indiana. Maine, Minnesota, New York, South Dakota, Tennessee, Vermont and Wyoming.

Outlook for Non-Ferrous Metal Markets a Big "?"

Purchasing Agents Reported Convinced That Long-Range Policy in This Field Is Presently Impossible

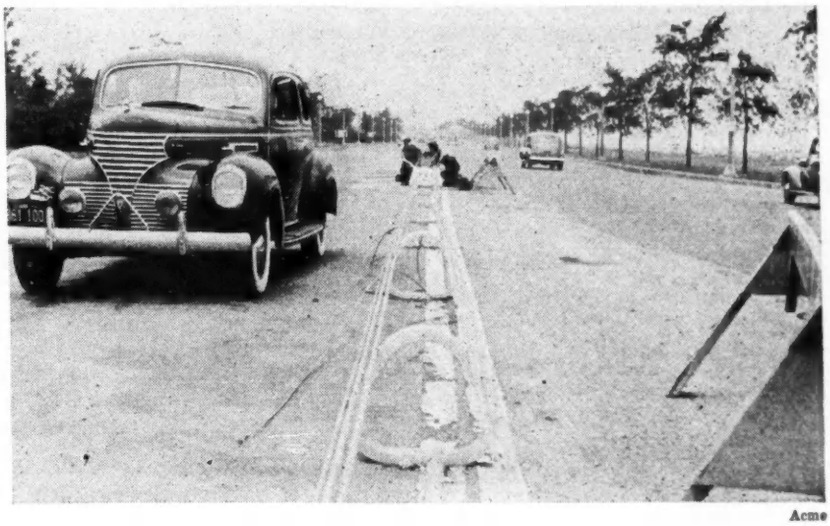
Taking stock early in July of the outlook in the non-ferrous metal markets, purchasing agents found little to alter their conviction that formulation of a long-range policy is out of the question at this time. Protection against what cannot be foreseen is hardly possible, and it is the unexpected that happens more frequently these days than the expected.

Export sales of copper on one recent day aggregated nearly 25,000 tons, the largest day's business in a long time. For some inexplicable reason, the price situation here remained entirely unaffected. More than four-fifths of the tonnage is reported to have been acquired for account of the French government, which would indicate that the metal is intended for armament manufacture. Yet it is frequently hinted that the very nations, one would suppose, who were husbanding every pound of copper, have built up such huge reserves that they are lightening their holdings whenever opportunity offers.

Just as confusing are some of the developments at home. In some quarters, the boost in the price paid by the Government for silver is interpreted as a move to stabilize the price of copper and other non-ferrous metals, in the mining of which silver is an important byproduct. Next to the electrical industry, automobile manufacture furnishes the most important outlet for copper and consumption per unit appears to be on the uptrend. Nearly all of it reaches the automobile manufacturer in fabricated and preponderantly in alloyed form, but purchasing agents are keenly aware that a rise of half a cent in the price of copper adds more than a cool million dollars to the annual metal bill of the automotive industries.

Many see in the recent steadiness of the price of tin an indication that the International Tin Committee has attained its objective under present world market conditions and is satisfied to let prices rest where they are. Spot Straits tin has been offered freely at 49 cents a pound for a week or so, without consumers showing much interest. Tin importers have made it clear to their European correspondents that constructive price policies must be shaped with a view to regaining lost ground, especially so when it comes to automotive consumption in the United States. Tin consumption in automobiles in 1929 is estimated to have been more than 16,500 gross tons. Estimates of last year's consumption are that just about one-half that tonnage was used. Not all of this decline resulted from the dip in car output. There has been for years a gradual reduction in the percentage of tin used in solders and white bearing metals. Substitutes have been found for many parts that formerly consisted of cast bronze. So it is little wonder that the International Tin Committee has been admonished

(*Turn to page 92, please*)



Acme

Cars Will Bounce—Not Buckle

Cables instead of concrete abutments are being installed as lane separators on Chicago's Lake Front Drive. The cables are stretched between concrete separators topped by a red light. It is believed that the resiliency of the cables will result in less damage to cars that may hit them than would concrete abutments.

Stormy Weather Forecast for Plan To Build "Self-Liquidating" Roads

Highway Phase of FDR's Proposed New Spending-Lending Program Seen Facing Uncertain Future

President Roosevelt's proposed new spending-lending program, under which $750,000,000 would go for the construction of "self-liquidating" toll roads and bridges over a four-year period, is expected to have stormy weather ahead, with the toll-road bite out of the $3,860,000,000 program facing as uncertain a future as other features of the proposal.

The highway phase of the program occasioned some surprise because of the Bureau of Public Road's recent report on express highways in which that agency looked with disfavor upon toll roads, characterizing them as traffic repelling and recommending that if Congress desired to experiment with the idea further that it authorize the construction of a road connecting Washington and Boston. The Bureau said that there would be reasonable prospects for recovering the costs through tolls.

When the President first announced the rough details of his spend-lend program, a list of toll roads and bridge projects was mentioned at the White House but more recently there have been reports that the Bureau, which will hereafter be known as the Public Roads Administration because of the government reorganization move effective July 1 transferring the agency to the new Federal Works Agency, was having difficulty in compiling a list of projects which it felt could measure up to the self-liquidating qualification. The new roads administration has neither denied nor confirmed this report but an inspection of its recent analysis on express highways lends credence to the rumors.

At the same time, members of the Senate who handle road legislation whenever highway construction is up for consideration in Congress, appeared to look with disapproval upon the President's proposed road-building program. A few days before the White House formally announced the spend-lend program, Senator McKellar, Democrat, of Tennessee, and chairman of the Senate Post Office and Post Roads Committee, characterized toll bridges as so unpopular that it would be "impossible to give them any place in a self-liquidating works program.

Similarly, Senator Hayden, Democrat, of Arizona, and ranking member of the committee, referred to newspaper reports that a new spending program was about to be launched by the Administration, expressing doubt that toll roads and bridges could be financed on a self-liquidating basis.

Interior Secretary Ickes, who was testifying before the Senate Appropriations Committee on the public works appropriations act for 1939, said at the time he had no inkling of the reported program but he readily agreed with Senator Hayden. Mr. Ickes has since lost his PWA post to John Carmody, new administrator of the Federal Works Agency.

The new Federal Works Agency consists of all government works and construction agencies consolidated under one head and includes the PWA, the WPA as well as the Bureau of Public Roads which was a division of the Agriculture Department. Dr. Thomas H. MacDonald becomes Commissioner of Public Roads under the new set-up.

Statistics Indicate Revival Of Auto Industry in France

Latest statistics of registration, production, and foreign commerce in motor cars point to a revival of the automobile industry in France. The number of private cars and commercial vehicles registered in France increased from 2,004,994 in 1937 to 2,268,985 in 1938. The number of cars produced in France in 1938 was 227,168, as compared with 207,430 in 1937. Foreign commerce in automobiles, on the other hand, suffered a further decline, exports of French cars having decreased from 25,114 to 23,785, while imports decreased from 2682 to 2294.

The statistics also show a material decrease in the consumption of fuel in France, which is believed to be due to repeated increases in the fuel tax, to which reference was made in some of the papers contributed by French authors to the World's Engineering Congress. The decrease in premium-grade gasoline was not large, from 19,993,085 to 19,642,555 hectoliters, but the drop in second grade was considerable, considering the increase in the number of cars in service, from 14,532,947 to 13,292,142 hectoliters. The decrease in the consumption of lubricating oils was even greater, from 75,500 to 67,645 tons.

ADVERTISING

Cleveland Tractor, Reo, and Kelvinator division of Nash-Kelvinator are a few of the important accounts of the newly-organized agency of Irwin Vladimir & Co., New York.

Miller McClintock, Yale University, told the Pittsburgh Advertising Club recently that by staggering the working day retail sales would be boosted and traffic hazards would be decreased. He suggested that office workers start at 8:30 and close the day at 4:30, and that retail stores open at 9:30 and close at 5:30 or 6.

Officials of Lee Anderson Advertising Agency believe that the new "style slant" of Chrysler advertisements have been important in the company's sales gain of 33 per cent. Incidentally, a wide variety of local promotion hook-ups is made possible by the new series.

A series of advertisements signed by H. F. Sinclair, president of Sinclair Refining Co., editorializes upon the benefits to industry in general of the

Hercules Diesel-Equipped Trucks on Tour

Here are two of five Hercules Diesel-equipped Ford tractor-trailer demonstration units now on tour with Ford caravans covering all sections of the United States. Four of the tractors are of the conventional type and one is a cab-over-engine model. While the Ford Motor Co. uses the identical Hercules engine in chassis it builds for the export market, it does not offer Diesel-equipped trucks or replacement engines in the United States. Hercules Motors Corp. is marketing these complete "packaged" replacement Diesels through a distributing organization. The exclusive distributors sell to, or through, the Ford dealers—and also directly to the truck owners

half-cent increase of tank wagon gasoline prices. Approving messages from other industrial and financial leaders are also used.

American Brake Shoe & Foundry Co., Rochester, maker of automotive and industrial compressors and equipment, has appointed Sidener & Van Riper, Indianapolis, its advertising agency.

Continental Oil Co., Ponca City, Okla., is using several traveling displays mounted in air-conditioned buses to promote its products.

General Motors Diesel division, Cleveland, has begun an advertising campaign promoting its powerplants. Early insertions have been scheduled in trade, business, and national magazines.

"Liquid Coal"—A New Fuel for Motor Vehicles

An interesting development of the Research Foundation of Armour Institute of Technology is the use of "Liquid Coal" as a motor vehicle fuel. Dr. Francis W. Godwin, who is a member of the Foundation staff and credited with the new development, estimates that another year of fundamental research work on "Liquid Coal" will be required before the fuel will be ready for the market.

According to Dr. Godwin, three different types of "Liquid Coal," or colloidal fuel, have been used successfully in tests employing a 1939 stock model automobile. The first of these fuels was a suspension of a specially prepared coal, ground to 300 mesh in a mixture of gasoline, fuel oil, and lubricating oil. The second test with the new fuel was made with a suspension of coal in a Diesel oil. The third test was made with a suspension of coal in a very light oil. In a recent demonstration a very light oil, or a form of range oil with a light fraction of hydrocarbon was used as the vehicle, followed by a special treatment with the coal, resulting in the suspension of coal of about 500 mesh. In each case, before the "Liquid Coal" was introduced into an auxiliary fuel tank on the automobile it was chemically stabilized in order to hold the coal in suspension.

The test car was started on gasoline and, after smooth running conditions had been attained and the engine had "come up to driving heat," the fuel system was changed so that the gasoline supply was cut off and the "Liquid Coal" introduced in the carburetor. Thereafter the engine was operated on the "Liquid Coal."

GM June Truck Sales Better '38 by 68%

Truck sales to consumers in the United States by General Motors Truck & Coach during the month of June were 68 per cent better than in June of 1938.

New Fuel for Motor Vehicles

Dr. Francis W. Godwin, of the Armour Institute of Technology, pours "Liquid Coal"—see article on this page—into auxiliary tank on standard stock model of 1939 automobile. Reports from the Institute state that the stock car has been operated successfully on the new fuel which, says Dr. Godwin, should be ready for the market in another year

Wagner Act

(*Continued from page* 81)

necessarily returned to an individual basis temporarily. Outbreaks of factional bitterness have caused serious disturbances in some plants, and the outlook is difficult to appraise."

Confronted with this situation, the manufacturer finds himself without a remedy, Mr. Cronin emphasized to the committee, explaining that unless one faction chooses to appeal to the NLRB and unless both are content to abide by the result of intervention, the manufacturer "will find himself ground between the millstones of union factionalism with the worker, the consumer, and the community ultimately bearing the consequences."

The witness laid emphasis on the industry's record for liberal treatment of labor, recalling that during the industry period of expansion, workers were generally unorganized yet for many years average wages were the highest for any major industry and hours and other working conditions in modern, up-to-date plants compared favorably if they did not surpass those to be found in any industry.

As a result, he continued, during this entire period of extraordinary expansion covering nearly 40 years, the industry was remarkably free from labor trouble, having experienced almost no strikes or other interruptions in production until quite recently. At this point Mr. Cronin traced the history of collective bargaining legislation from the advent of the NRA up to the present time.

Turning to the subject of sit-down strikes, he told the committee that certain features were characteristic of all these incidents. First, he said, they followed closely the pattern established by syndicalists in France during the summer of 1936; they were not spontaneous but obviously according to carefully prearranged plans; they were participated in by small minorities of the employes when the union had consistently refused to offer evidence that it represented more than a minority; and each was carefully organized with a small group of leaders taking charge as soon as a signal for the sit-down was given.

In most cases involving the sit-down, a considerable number of employes were trapped in the buildings and forced to participate against their will but some of these later escaped at night or by various devices, he related. Sleeping and cooking equipment were rushed into plants from previously prepared stores, contempt was displayed for law enforcement authorities and elaborate preparations made for resistance, including construction of barricades, and manufacture of weapons. If attempts were made to eject strikers, threats were made to destroy plants, machinery and materials. In short, he asserted, a more or less complete breakdown of law and order occurred, with armed thugs patrolling highways, stopping cars, and searching occupants, as well as terrorizing the citizenry.

Mr. Cronin estimated that the aggregate loss to employes from the sit-down strikes in the plants of four companies amounted to about $44,210,000 in wages, an average of more than $200 for each employe affected. To these he added the industry's cost for damaged equipment, materials, and plants and losses due to suspended operations—costs which he

(*Turn to page* 89, *please*)

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

BUSES Rate of operations remains unchanged in most plants at approximately 50 per cent capacity. Rumors filtering in from the New York area indicate interest in dual-rear-wheeled buses for infantry mechanization, although there is no official confirmation.

TRUCKS Evidence in several quarters of a livelier interest in new equipment. Production and retail demand said to be "holding up well."

TRACTORS Note of optimism creeps into this picture as several major companies report conditions improving.

AUTOMOBILES For the week ended July 8 it is estimated that 45,000 cars and trucks were produced. Output for the week ended July 15 was expected to reach 64,000. Several major companies probably will continue 1939 model operations throughout July.

MARINE ENGINES While business is held to be "better than fair," the manufacturers in this field are not enjoying the volume anticipated earlier in the year. Outboard builders indicate that production is slightly ahead of 1938.

AIRCRAFT ENGINES Increased government orders are building up backlogs so fast that in some cases engine manufacturers have urged private consignees "to be patient." A good deal of new equipment has been installed during the past month.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

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ABSTRACTS

Piston Ring Developments

If piston rings are tested with respect to roundness, by surrounding them with a steel band and applying tension to the ends of the band until the gap has been closed to the predetermined value in the cylinder, and then measuring diameters in line with the gap and at right angles thereto, correctly-proportioned "expanded" rings always show a larger diameter in line with the gap than at right angles thereto. The diameter in the former direction is from 0.3 to 0.6 per cent greater than in the latter. Piston rings put under pressure by heat treatment usually are found to be absolutely round when subjected to this test. Rings which are out of round in the opposite direction, that is, in which the diameter in line with the gap is less than that at right angles thereto, are bad; their ends press against the cylinder wall with low specific pressure, and they therefore "collapse" at relatively low speeds.

With continued wear, the distribution of the pressure over the circumference of the ring changes. Wear naturally is greatest where the ring presses hardest, and the distribution of pressure tends to become equal in the course of time, provided the ring does not suffer any abnormal injury. But aside from the fact that equalization can occur only after a considerable period of service, the original higher pressure near the ends in rings of the expanded type tends to prevent collapse and consequent injury to the ring by blowby, thereby increasing the life of the ring.

High engine speeds call for high radial pressures, and beyond that for additional specific pressures near the gap. Piston rings produced in accordance with the current German standard, which is based on a ratio of 1:25 between the radial thickness and the nominal diameter, give radial specific pressures of from 14 to 17 lb. per sq. in., if a gap length of 12 per cent of the diameter is assumed and the modulus of elasticity of the material is of the order of 14,000,000 lb. per sq. in. Higher specific pressures can be obtained only by increasing the ratio of radial thickness to nominal diameter, and it has become the practice to use a ratio of 1:23. At the same time the length of the gap must be increased, in order to keep the stress in the ring while it is being stripped over the piston, as well as the stress in service, within reasonable limits. The specific radial pressure of such radially-thickened, high-pressure rings is from 24 to 28 lb. per sq. in.

Piston rings exerting such high radial pressures cannot be used indifferently in all types of engines. If trouble is to be avoided, the cylinders must be very copiously lubricated, and all devices designed to restrict the amount of oil spray reaching the cylinder walls must be eliminated. In order to facilitate the wearing in of such high-pressure rings, their surfaces are prepared either by oxidizing, phosphorizing, or tinning.—ATZ, May 25.

Great Britain's Imports of Aluminum Increase Sharply

Increased use of aluminum alloys in Great Britain by the aircraft, automobile and other engineering industries has resulted in a sharp increase in aluminum imports, reports reaching the Commerce Department show. Imports from Canada and Switzerland, the two outstanding supplying countries, were valued at $6,540,000 during the first four months of 1939, a 56 per cent increase compared with the corresponding period of last year.

Many British companies formerly producing ferrous metals, have turned to the manufacture of light alloys, while other firms already well established as producers, are greatly expanding plants in order to meet the growing demands. The report said that British authorities estimated that the consumption of aluminum in the country during the first quarter of 1939 was approximately 35 per cent higher than in the corresponding period of 1938 and that aluminum alloy production of existing British factories, totaling about 2500 tons per month, is to be doubled within the next 10 months and is scheduled to reach over 4000 tons per month by March, 1940.

$25,000,000 Awarded For Aircraft Engines

Contracts totaling $25,009,389.64 were awarded last week by the War Department for aircraft engines for the Army Air Corps expansion program. The award is believed by the War Department to be the largest of the kind it ever let since the World War.

The Allison Engineering Co., Speedway, Indianapolis, was awarded a $15,-

New Car Registrations and Estimated Dollar Volume by Retail Price Classes*

	APRIL, 1939		FIRST FOUR MONTHS, 1939			
	Units	Dollar Volume	Units	Per Cent of Total	Dollar Volume	Per Cent of Total
Chevrolet, Ford and Plymouth	148,267	$108,400,000	495,946	56.02	$362,700,000	48.34
Others under $1,000	96,453	88,500,000	308,016	34.80	283,800,000	37.82
$1,001 to $1,500	19,510	22,700,000	68,492	7.74	80,100,000	10.68
$1,501 to $2,000	2,870	4,400,000	8,283	.94	12,800,000	1.70
$2,001 to $3,000	1,097	2,500,000	4,157	.47	9,500,000	1.27
$3,001 and over	87	400,000	303	.03	1,400,000	.19
Total	268,284	$226,900,000	885,197	100.00	$750,300,000	100.00
Miscellaneous	51	.....	330			
Total	268,335	$226,900,000	885,527			

* All calculations are based on delivered at factory of five-passenger, four-door sedan, in conjunction with actual new car registrations of each model. The total dollar volumes are then consolidated by price classes.

080,261.83 contract for 1000-hp., 12-cylinder, liquid cooled engines for pursuit planes. An award of $8,975,317 was given the Wright Aeronautical Corp., Paterson, N. J., for double row, radial, air-cooled engines for bomber planes which it is planned to procure from the Douglas Aircraft Co. The Pratt & Whitney Aircraft division of the United Aircraft Corp. was awarded a contract at $953,810.81 for single row air-cooled engines of approximately 500-hp. for installation in combat planes which it is planned to procure from the North American Aviation Corp.

Automotive Exports and Imports for May

	MAY 1939		MAY 1938		FIVE MONTHS ENDED MAY 1939		1938	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 20,562,751		$ 23,753,181		$ 138,386,854		$ 123,869,401
PASSENGER CARS								
Passenger cars and chassis	12,025	7,389,791	14,317	8,777,802	82,996	51,864,879	79,325	48,795,513
Low price range $850 inclusive	10,652	5,890,676	12,740	7,188,148	72,418	40,356,857	70,529	39,531,892
Medium price range over $850 to $1,200	1,169	1,151,562	1,413	1,330,735	9,055	8,949,420	7,596	7,251,508
$1,200 to $2,000	170	252,392	140	198,482	1,215	1,795,729	994	1,480,380
Over $2,000	34	86,161	24	60,437	308	762,873	206	531,733
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	7,434	5,165,057	10,770	6,470,049	60,882	38,487,485	53,609	33,151,626
Under one ton	1,238	558,207	1,515	639,835	8,636	3,657,896	8,175	3,470,550
One and up to 1½ tons	4,543	2,612,905	8,128	4,465,208	41,760	22,657,147	37,185	20,192,671
Over 1½ tons to 2½ tons	976	815,535	678	605,773	6,495	5,270,699	5,723	4,946,987
Over 2½ tons	525	1,071,602	421	727,808	3,081	6,226,326	2,152	4,213,223
Bus chassis	152	106,808	28	31,425	930	675,417	374	328,195
PARTS, ETC.								
Parts except engines and tires		3,923,457		3,598,456		25,009,719		16,896,046
Automobile unit assemblies		2,882,315		3,402,773		15,589,228		16,097,361
Automobile parts for replacement (n.e.s.)		333,432		356,932		1,475,861		1,607,595
Other automobile accessories (n.e.s.)		549,259		551,474		2,642,216		2,610,851
Automobile service appliances								
Airplanes, seaplanes and other aircraft	103	5,102,526	156	6,909,332	342	16,556,780	583	24,088,082
Parts of airplanes, except engines and tires		2,162,903		1,207,721		9,753,825		8,139,017
INTERNAL COMBUSTION ENGINES								
Stationary and Portable								
Diesel and semi-Diesel	44	312,387	55	354,559	235	1,190,063	190	768,292
Other stationary and portable								
Not over 10 hp.	1,147	73,081	1,130	86,834	5,039	342,395	5,652	334,736
Over 10 hp.	591	214,676	76	49,520	1,784	704,639	573	415,063
Engines for:								
Motor trucks and buses	1,701	201,598	2,538	314,675	14,312	1,581,696	12,346	1,473,194
Passenger cars	2,155	190,604	2,773	249,113	25,411	2,066,891	13,596	1,279,860
Aircraft	80	529,792	196	1,380,683	498	2,742,651	612	4,183,640
Accessories and parts (carburetors)		226,312		258,390		1,234,158		1,108,998
IMPORTS								
Automobiles (dutiable)	42	28,966	38	31,334	274	166,927	203	153,732

Wagner Act

(*Continued from page* 87)

did not attempt to estimate.

"Industrial peace will certainly continue remote so long as minorities or leaders, for their own purposes or aggrandizement, may call strikes without penalty or loss of status regardless of contract provisions or the wishes of a majority of the workers themselves," Mr. Cronin declared. "The realities of industrial relations today, and the practical application of the National Labor Relations Act and similar legislation, actually place such elements beyond all law or control."

Mr. Cronin appeared before the committee the week after the National Labor Relations Board announced it was amending its rules to permit employers under certain circumstances to petition for collective bargain elections —an announcement which stirred speculation as to whether the effect of the move would be to head off efforts to investigate the board and to revise the Wagner Act. Some observers, however, regarded the NLRB statement as an opening wedge through which even broader revision of the law may be possible next session.

Members of the House, who are openly hostile to the NLRB used the announced change in labor board rules as a cue to press for a proposed investigation of labor board activities—a proposal which has for months been hanging heavily over the heads of board members. Some congressional members regarded the labor board's decision as a step in the right direction but pointed out that except in a few instances the change of rules may not prove of great importance and that in any event the new rule fails to go to the heart of the problem. They indicated that the NLRB merely wanted to patch up the existing law when what was actually needed was a revised law and a fresh approach through an impartial Congressional investigation as proposed in a pending House resolution.

The NLRB said in a mimeographed statement to the press that it had "ordered amendment to its rules and regulations to permit employers to petition the Board in representation cases where two or more bona fide labor organizations are claiming a majority, but neither petitions the Board for certification." The Board, the statement added, will also amend its rules so that the period of notice of hearing in unfair labor practice cases shall be not less than 10 days. The former rule allows five days' notice.

Estimated Dealer Stocks of New Passenger Cars

1938	January	February	March	April	May	June
Production—U. S. Domestic Market†	130,273	119,896	153,316	160,028	140,239	123,333
Retail Sales—U. S.‡	126,442	120,348	188,325	193,392	187,306	155,811
Change in Inventory	+3,831	−452	−35,009	−33,364	−47,067	−32,478
Inventory, first of month	408,157	411,988	411,536	376,527	343,163	296,096
1938 (continued)	**July**	**August**	**September**	**October**	**November**	**December**
Production—U. S. Domestic Market†	96,975	53,955	60,177	171,371	295,366	305,900
Retail Sales—U. S.‡	153,426	123,711	90,629	134,984	241,009	241,623
Change in Inventory	−56,451	−69,756	−30,452	+36,387	+54,357	+64,277
Inventory, first of month	263,618	207,167	137,411	106,959	143,346	197,703
1939	**January**	**February**	**March**	**April**	**May**	**June**
Production—U. S. Domestic Market†	263,225	223,745	279,148	257,058	222,909	.....
Retail Sales—U. S.‡	180,651	165,841	276,301	265,756	275,457	.....
Change in Inventory	+82,574	+57,904	+2,847	−8,698	−52,548	.....
Inventory, first of month	261,980	344,554	402,458	405,305	396,607	344,059

†—U. S. Census Bureau. ‡—Automobile Manufacturers Association.

PUBLICATIONS

The **"Standard Highway Safety Program for States,"** a pamphlet issued by the Automotive Safety Foundation, describes a working program to increase traffic efficiency and reduce accidents.

Much valuable data will be found in "Practice in Machining Zinc Alloy Die Castings," a new booklet published by the New Jersey Zinc Co., New York.

A brief survey of the finances and revenues of **aircraft manufacturers and air transport** in the United States will be found in the brochure entitled "Looking Up with Aviation," recently published by the National Credit Office, Inc., New York.*

Manganese steel is discussed in considerable detail in catalog 59 brought out by the American Manganese Steel Div., The American Brake Shoe & Foundry Co., Chicago Heights, Ill.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Tire Dealers Fight Cut Price Advertising

Independent Merchants File Injunction Suits and Also Suits for Damages Against Major Manufacturers

Independent tire merchants, just preceding the Fourth of July holiday, put a quietus to major tire manufacturers' cut price advertising by filing injunction suits and also suits for damages. The main actioned centered in Atlanta, Ga., but had its effect nationally. Cut price advertising threatened to undermine the tire industry's price stabilization program, but first line tires remained practically immune with the price cutting being confined to second and third lines which are in price competition with private brand tires of oil companies and mail order houses.

In Atlanta independent dealers obtained their injunction in superior court against major manufacturers on the ground that their advertising was false and misleading in that the announced price levels from which the reductions were made, were fictitious and were above the true original prices. The dealers asked damages from the defendent manufacturers. This is the first time on record that dealers have enjoined manufacturers from cutting prices or running price-cut advertising. Prices firmed up immediately after July 4, with little damage done to the leading tire lines.

Manufacturers report that replacement sales for the first six months exceeded 16,000,000 units as against less than 13,000,000 in the first half a year ago. With consumer tire buying continuing to run ahead of a seasonal pace they now see a 33,000,000 unit year as a certainty. Manufacturers stocks are slightly higher than a year ago, but are not top-heavy. The manufacturer sales values of tires and tubes and tire sundries shipped in the first quarter of 1939 was $87,781,000 against $87,102,000 a year ago and $60,384,000 in 1937. May tire shipments were 4,753,405 units—an increase of 9.1 per cent above April and of 44.4 per cent above May figures for 1938. May production totaled 4,418,072 units against 4,211,152 in May of 1938 and 2,662,623 in May of 1937. Inventories at the end of May were 9,918,759 casings against 9,997,527 a year ago.

Shipments of Replacement Parts Increased in May

Shipments of automotive replacement parts and service equipment advanced in May, according to manufacturers reporting their business figures to the Motor and Equipment Manufacturers Association, while there were declines in original equipment and accessories shipments. MEMA reports that its grand index for all branches of the industry in May dropped to 128 per cent of the January 1925 base as compared with 136 per cent for April and 89 per cent for May 1938.

Shipments to vehicle manufacturers for original equipment in May declined to 120 per cent of the base, which compares with 129 per cent registered in April and 82 per cent for May last year.

Service parts shipments to wholesalers for May advanced to 154 per cent of the base as compared to 150 per cent in April. In May 1938 the index stood at 108 per cent.

Accessories shipments to wholesalers in May dropped, standing at 115 per cent of the base index, which compares with 132 per cent for April and 102 per cent in May 1938.

Service equipment shipments to wholesalers in May rose to 108 per cent of the base, which compares with 105 per cent in April and 101 per cent in May 1938.

Thompson Products Will Issue 20,000 New Shares

Thompson Products, Inc., has filed with the Securities and Exchange Commission a registration statement covering 20,000 shares of convertible prior preference stock with a dividend rate of $5 per share per annum. The shares will be offered, at a price to be supplied by amendment, by a group of underwriters headed by McDonald-Coolidge & Co.

The shares will be convertible into common stock at $100 a share for prior preference stock and $30 a share for common stock. They are redeemable at 105 and accrued interest.

Proceeds of the financing will be used to retire short-term bank indebtedness amounting to $1,650,000, and for additional working capital, according to the registration statement. The bank loans were incurred during the period from Jan., 1936, to Dec., 1938, when current assets of the corporation and subsidiaries increased from $3,330,689 to $5,109,366.

Upon completion of this financing, capital structure will consist of 28,945 shares of $5 convertible prior prefer-

New Passenger Car Registrations

	MAY 1939	APRIL 1939	MAY 1938	FIVE MONTHS 1939	FIVE MONTHS 1938	Per Cent Change, 5 Months, 1939 over 1938	Per Cent of Total Five Months 1939	Per Cent of Total Five Months 1938	SEVEN MONTHS MODEL YEAR 1939	SEVEN MONTHS MODEL YEAR 1938	SEVEN MONTHS MODEL YEAR Per Cent Change
Chevrolet	65,003	64,230	44,023	274,221	202,792	+ 35.0	23.53	24.81	378,205	308,207	+ 22.7
Ford	49,352	46,207	35,518	207,773	173,724	+ 20.0	17.83	21.25	274,359	221,094	+ 24.2
Plymouth	39,680	37,830	27,921	166,987	111,431	+ 50.3	14.33	13.63	234,279	161,110	+ 45.1
Dodge	22,631	20,677	9,923	90,565	46,044	+ 96.8	7.77	5.63	118,634	71,655	+ 65.5
Buick	20,591	21,223	14,740	90,180	67,188	+ 34.3	7.74	8.22	128,011	100,996	+ 28.0
Pontiac	16,557	15,751	8,959	67,780	42,479	+ 59.5	5.82	5.20	93,520	65,366	+ 43.1
Oldsmobile	14,339	14,062	8,900	61,664	40,100	+ 54.0	5.29	4.90	87,067	60,249	+ 44.5
Chrysler	7,457	6,855	4,600	31,654	21,219	+ 49.0	2.72	2.60	42,451	33,582	+ 26.1
Studebaker	8,780	7,273	2,928	27,059	14,564	+ 85.6	2.32	1.78	36,527	22,265	+ 64.6
Mercury	6,776	6,027		26,169			2.24		33,004		
Nash	5,504	5,997	3,146	24,130	14,745	+ 63.4	2.07	1.80	29,734	22,091	+ 35.0
De Soto	5,488	5,423	3,293	23,254	15,885	+ 46.0	2.00	1.94	31,339	25,068	+ 25.1
Hudson	5,239	5,046	3,605	21,339	17,796	+ 19.7	1.83	2.18	30,746	27,065	+ 13.8
Packard	6,059	4,320	4,747	19,931	21,462	− 7.1	1.71	2.62	28,998	32,271	− 10.0
La Salle	2,208	2,349	1,373	9,603	6,160	+ 55.9	.82	.75	14,207	9,599	+ 48.0
Lincoln	1,899	1,845	1,621	8,812	7,938	+ 11.0	.76	.97	12,174	11,378	+ 7.0
Cadillac	1,285	1,277	1,097	5,864	4,849	+ 21.0	.50	.59	8,520	6,106	+ 39.8
Willys-Overland	1,099	1,119	1,058	4,976	5,932	− 16.1	.43	.73	6,898	10,385	− 33.5
Graham	540	441	365	2,012	2,162	− 7.0	.17	.26	2,726	3,522	− 22.4
Hupmobile	184	216	124	555	498	+ 11.5	.05	.06	656	604	+ 8.9
Bantam	129	116		469			.04		469		
Fiat	6	5		52					52		
Miscellaneous	28	46	111	312	671	− 53.5	.03	.08	618	1,117	− 44.6
Total	280,834	268,335	178,052	1,165,361	817,639	+ 42.8	100.00	100.00	1,593,187	1,193,730	+ 33.5
Chrysler Corp.	75,256	70,785	45,737	312,460	194,579	+ 60.8	26.82	23.80	426,703	291,415	+ 46.1
Ford Motor Co.	58,027	54,079	37,139	242,754	181,662	+ 33.8	20.83	22.22	319,537	232,472	+ 38.0
General Motors Corp.	119,983	118,892	79,092	509,312	363,568	+ 40.1	43.70	44.47	709,530	550,523	+ 29.0
All Others	27,568	24,579	16,084	100,835	77,830	+ 28.8	8.65	9.51	137,417	119,320	+ 15.1

ence stock authorized and outstanding, with 500,000 common shares authorized and 293,290 shares outstanding.

General Tire & Rubber Co. Reports Six Months' Profit

Net profit of the General Tire and Rubber Co. and subsidiaries for the six months' period ending May 31, 1939, was $1,103,575.38, equivalent to $1.96 per common share.

General Tire's net sales amounted to $10,917,345.94 during the half-year period, which was an increase of 31.2 per cent over the same period in 1938, when net sales totaled $8,322,039.48.

CALENDAR

Conventions and Meetings

National Petroleum Association, Annual Meeting, Atlantic City, Sept. 13-15

SAE Tractor Meeting, Hotel Schroeder, Milwaukee, Wis. .....Sept. 28-29

SAE National Aircraft Production Meeting, Ambassador Hotel, Los Angeles, Calif. .....Oct. 5-7

SAE Annual Dinner, Hotel Pennsylvania, New York, N. Y.....Oct. 16

American Welding Society, Annual Meeting, Chicago .....Oct. 22-27

American Trucking Association, Annual Meeting, Chicago .....Oct. 23-24

SAE Transportation & Maintenance Meeting, Coronado Hotel, St. Louis, Mo. .....Oct. 26-27

SAE Fuels & Lubricants Meeting, Mayo Hotel, Tulsa, Okla. .....Nov. 2-3

American Petroleum Institute, Annual Meeting, Chicago .....Nov. 13-17

National Independent Traffic League, Annual Meeting, Chicago....Nov. 23-24

Motor & Equipment Wholesalers Association, Annual Convention, Chicago .....Dec. 8-9

SAE Annual Meeting & Engineering Display, Book-Cadillac Hotel, Detroit .....Jan. 15-19, 1940

Shows at Home and Abroad

Automobile Accessories Association, Sixth Annual Exposition, Navy Pier, Chicago .....Aug. 7-10

National Machine Tool Show, Cleveland .....Oct. 4-13

Great Britain, London, Automobile Show .....Oct. 12-21

National Automobile Show, New York, Oct. 15-22

National Metals Congress and Exposition, Chicago .....Oct. 23-27

Italy, Milan, Automobile Salon, Oct. 25 to Nov. 11

International Automobile, Motorcycle and Motor Boat Show, Budapest, Oct. 27 to Nov. 6

Great Britain, London, Commercial Automobile Transportation Show, Nov. 2-11

National Truck Show, Chicago....Nov. 8-16

Great Britain, Glasgow, Scotch Automobile Show .....Nov. 10-18

Automotive Service Industries Show, Navy Pier, Chicago .....Dec. 11-16

Achievement Issue of Automotive Industries

Planned to Reap An October Harvest of New Ideas

NEW MACHINES, new techniques, new controls, new materials, new designs will fill the minds of automotive manufacturing executives at the Machine Tool Show beginning Oct. 4 in Cleveland and at the National Automobile Show opening in New York on Oct. 15.

Two such events of major importance to the automotive industry demand an editorial program of unusual significance — such a program as will materialize in .....

..... The Achievement Issue of Automotive Industries

Highlighting the Machine Tool Show

A SPECIAL SECTION, packed with "things you never knew 'til now," will reduce "40 years of machine tool progress" to its terse, dramatic essentials. And, through an authoritative review of engineering progress in 1940 automobiles, to a thorough review of new machines and new machining practices on new materials, the issue will explore new and important automotive paths.

Plastics, die castings and new non-ferrous alloys will find wider use in 1940 cars. Special articles on each of these subjects will chart the scope of these new materials and discuss the new fabricating techniques which they involve.

Styling of new automobiles is becoming more and more indebted to the work of creative designers who work both in the automobile industry and in the general field of industrial design. A pictorial article will introduce these men and tell what they have contributed to 1940 car design.

Readers of AUTOMOTIVE INDUSTRIES will find in the Achievement Issue—Highlighting the Machine Tool Show a truly comprehensive and excitingly interesting record of the new products and new ideas to be disclosed at the Machine Tool Show and the National Automobile Show. Timed to precede both events, the value of this issue as a book of reference will outlive the influence of either.

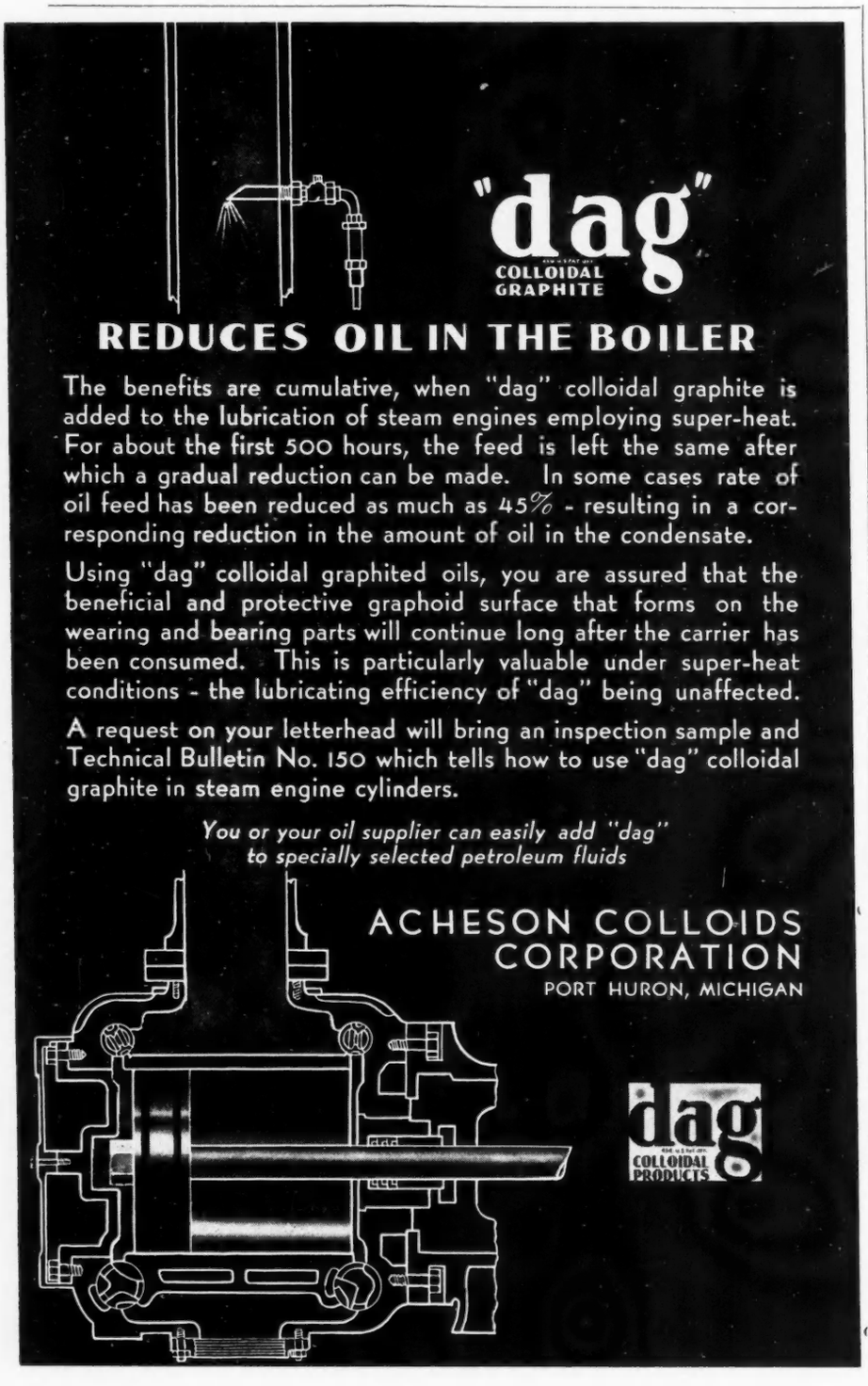
The Achievement Issue — Highlighting the Machine Tool Show will be published Oct. 1.

Metal Markets

(*Continued from page* 85)

to go slow and not to alienate further one of its most important outlets. Tin stocks in the United States and metal afloat to this country assure a supply this month.

Shutdowns in the steel industry ranged all the way from two to six days during the first week of July and one independent announced that some of its mills would shut down for a thorough job of modernization until August. An ample stock of semi-finished steel has been accumulated to permit flat-rolling and finishing of whatever orders come in during the shutdown of other departments. According to the American Iron & Steel Institute, operations during the Fourth of July week receded to 38.5 per cent of capacity, which, considering the four-day week and longer shutdowns elsewhere, is a normal showing, portending the early return to better than 50 per cent of capacity.—W. C. H.


"dag"
COLLOIDAL GRAPHITE
REDUCES OIL IN THE BOILER
The benefits are cumulative, when "dag" colloidal graphite is added to the lubrication of steam engines employing super-heat. For about the first 500 hours, the feed is left the same after which a gradual reduction can be made. In some cases rate of oil feed has been reduced as much as 45% - resulting in a corresponding reduction in the amount of oil in the condensate.
Using "dag" colloidal graphited oils, you are assured that the beneficial and protective graphoid surface that forms on the wearing and bearing parts will continue long after the carrier has been consumed. This is particularly valuable under super-heat conditions - the lubricating efficiency of "dag" being unaffected.
A request on your letterhead will bring an inspection sample and Technical Bulletin No. 150 which tells how to use "dag" colloidal graphite in steam engine cylinders.
You or your oil supplier can easily add "dag" to specially selected petroleum fluids
ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN
dag
COLLOIDAL PRODUCTS

THE CHILTON ROUND TABLE

In order to give readers of AUTOMOTIVE INDUSTRIES a clue to certain merchandising and service aspects of the automotive industry which are normally outside the scope of an industrial publication, we present herewith excerpts from the July issues of the other magazines published by the Automotive Division of the Chilton Co.

From AUTOMOBILE TRADE JOURNAL

Dealer regulatory - licensing legislation is on the books of the following states: Wisconsin, Iowa, Nebraska, Ohio and Texas. Texas has enacted an "enabling act" empowering municipalities to set up regulatory licensing of dealers, which has been done only in Houston and Dallas.

Licensing laws are in effect in other states but not of the "Wisconsin type." Regulatory licensing failed to pass in Maryland, Minnesota and California recently. A bill is pending in Illinois. Pennsylvania's appraisal bureau licensing law failed last year on grounds of constitutionality.

(Two able dealers discuss the pros and cons in the ATJ columns.)

From COMMERCIAL CAR JOURNAL

The 1939 legislative year is drawing to a close so far as most of the states are concerned. Of the 44 state legislatures convened since last January only 11 remain in Chambers as this is being written.

Some of the state legislatures levied additional imposts on the motoring public and proposed increases are still pending in other states.

"Emergency" taxes all continued; one increase no reductions; bill to reduce defeated in 10 states; bills to increase defeated in 8 states.

From MOTOR AGE

Electrical work, it should be pointed out, is really a safety service, as good wiring reduces the hazard of fire. A survey made in the city of Columbus disclosed that 116 automobile fires out of 425 were caused by defective wiring.

There are many parts and equipment companies that have manuals that give instructions on trouble shooting. Every good mechanic and shop owner should have one.

Owing to conflicting closing dates it was impossible to obtain material from the columns of *Motor World Wholesale*.

Strikes Enforce Idleness of 6000 General Motors' Workers

Walkout Aimed at Tie-Up of Production On 1940 Models Closes Nine Factories

With the Fisher Body plant at Cleveland and the Chevrolet plant at Saginaw joining the strike closed plants of General Motors', the total number of plants closed on July 10 was nine. The walkout, enforcing idleness of 6000 men, started July 5 when workers among the tool and die, engineering and maintenance employes of GM pulled switches in Fisher Body plant No. 21.

Official demands listed in the union bulletin were: All tools, dies, jigs and fixtures to be used in the plants to carry a union label; A uniform minimum hiring rate for all GM plants; Wage increases of at least 10 cents an hour; Overtime provisions of time and a half for Saturdays and double time for Sundays and holidays; A standard apprentice set-up for all GM plants.

On July 6, with already 3700 GM skilled workers forced into idleness by the strike, James F. Dewey arrived in Detroit to attempt a settlement. General Motors announced on July 7, third day of the strike, that inasmuch as the walkout "threatens definitely to delay production of 1940 models" and force thousands of workers into idleness that its employe income security plan would be suspended immediately. As previously reported in AUTOMOTIVE INDUSTRIES provisions of the plan include advances by GM to employes "to avoid the complete loss of income to the eligible employes" during slack seasons in the automotive industry. The plan was not set-up to apply in case of strikes or "circumstances beyond the control of the corporation."

The strike difficulties were summed up in the words of Mr. Knudsen as follows: "This strike is not on account of low wages or bad working conditions. Such conditions do not exist in General Motors plants. The situation is simply another chapter of the jurisdictional fight between two factions of the UAW.

"We have negotiated and are still willing to negotiate with the representatives of any group of our employes, but we cannot negotiate the provision of an existing contract with either of the two factions of the UAW as long as both claim rights thereunder, until the court or NLRB has established, as a matter of law, which faction is the responsible party to that contract."

40 YEARS AGO

While the philologists are amusing themselves with the invention of new names for the motor vehicle a Western newspaper spontaneously springs upon us a name which, in length and breadth, far surpasses any the philologists have yet been able to invent. It is "horseless carriage bicycle," a medley of horses, bicycles and carriages that is not so inappropriate a description of the work of some of our inventors as might be supposed.

From *The Horseless Age*, July 1899.

English Firm Develops Hydro-Mechanical Brake

New Hudson, Ltd., Birmingham, England, manufacturer of the Girling mechanical brakes, and now one of the largest producers of brake equipment specialists in Europe, has introduced a combined hydraulic and mechanical system. To eliminate the problems involved in applying mechanical brake linkage to cars with independent front springing, the front sets are operated hydraulically. To simplify compliance with English law, which insists that at least two wheels shall have brakes with

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New Type Brake

(*Continued from page* 93)

mechanical operation, either by pedal or hand lever, the rear brakes of the new system are on the same lines as the Girling mechanical type. Both sections are operated by the same pedal, though the rear brakes are coupled also to the hand lever.

The master cylinder of the hydraulic section forms the stem of the pedal plate. Thus pressure on the latter is conveyed equally to the hydraulic fluid and to the pedal lever, though it is arranged that somewhat greater effort shall be conveyed to the front brakes.

There is a metal-to-metal seal within the master cylinder, consisting of a small piston ring held in a recess by a light coil spring. It is said that even with light mineral oil such an effective seal is gained that with 1,000 lb. per sq. in. initial pressure, the pedal takes 27 hours to make a full stroke. Ordinary mineral oil having a flash point of 330-340 deg. Fahr. and a pour point of 60 deg. Fahr. can be used. But as such a fluid would be harmful to rubber, all flexible tubing is made of Neoprene. Annealed steel tubing is used elsewhere. Neoprene is also used for the cups of the wheel cylinders. The latter are external to the drums and horizontal; they operate through the normal Girling type expander, but by pushing instead of pulling.

Plastic Automobile

(*Continued from page* 59)

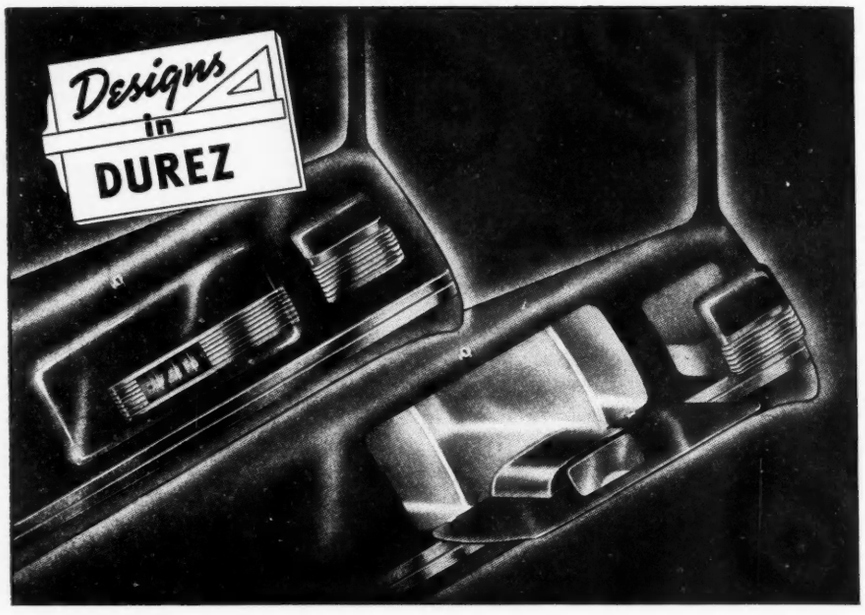
of the time during which the dies and press are not working. If the plastic material in the form of sheets or blanks were preheated outside of the press and dies, and then stamped or rapidly pressed to the desired shape, the number of pieces per machine and per man could be increased to a point where plastic molding would be feasible for use in the automotive industry. Alternative to this would be a material which could be cold formed and subsequently polymerized outside of the dies and press without warping or cracking.

As long as motor vehicles are operated by human beings there will be accidents, and accidents require subsequent repairs. If plastics were used for many body parts they would have to have the ability to be repaired in some manner; by gluing, by patching on new material to cover or replace damaged material, by bonding together parts or sections torn apart in a crash, or by some heating process similar to the welding of metals, or a plastic which can be used exactly as solder is now used to fill up depressions in metals.

For the sake of safety to the occupants of the "plastic automobile" and to the occupant of possible colliding vehicles, the material or construction must be fireproof and shatterproof. In fact, the body extremities such as fenders must be capable of absorbing the energy of a crash and thus diminish the possible harm to passengers within the structure. This would require a material which does not easily fracture, but which rather bends to absorb the shock of collision.

Automobile manufacturers have to maintain large stocks of replacement parts for some 10 to 15 years. Over this period of time the parts must not lose their original structural and functional properties. It is necessary that plastic parts held for replacement stock must possess the same properties after aging for a decade, as they had the day of fabrication. This property of stabilized aging would also apply to the appearance and finish of the parts. The finish must be capable of enduring extremes in climate, and all the handling encountered in manufacturing and storing. In other words, a reasonably hard, durable finish must cover a fade-proof color and a strong but flexible internal structure.

In conclusion, the ideal plastic material for use in the automobile would have the strength and rigidity of alloy steel, the ease of forming and shaping of potter's clay, the toughness of sugar maple, the colors of the rainbow, and the finish of "Superfinished" tool steel.



Idea For a MOLDED DASHBOARD COMPARTMENT

It doesn't take a salesmanager to know that it's the sum total of the little distinctions that adds up to sales. Such an eye-pleasing touch is this spirited dashboard compartment designed in molded Durez by Joseph B. Federico.

The compartment, pigeonholed to keep gloves, roadmaps and what-have-you unscrambled is designed for molding in one piece. So is the door, which contains a jump dial-clock housing and mirror—and the ash tray, which slides on noiseless Durez tracks. Trim chromium plated fittings complete the effective ensemble.

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